Low Pressure Water Supply.

Written for ENGINEERING NEWS.

BY CHAS. W. BAKER, C. E.

Those who have noticed the statistical tables of Mr. J. J. R. Croes, published in the last volume of this journal, showing the pressure in the water mains of American cities, must have been impressed by the general prevalence of high pressures.

There are several reasons for this, the first and most important of which is the general use of the hydrant pressure for throwing fire streams. Especially in the smaller cities this practice has become well nigh universal, and it is by no means the purpose of this paper to say aught against a custom which has been found to possess so much practical merit. It may be said, however, that it is also the very general practice to increase the pressure in case of fire alarms; and it seems that where proper means are taken for accomplishing this, the works may be designed for a low pressure without endangering the city's safety in case of fire.

There are other reasons, however, besides the potent one already named, for the use of high pressure. Two very practical ones are that smaller pipe may be used for mains and services, and that both are less liable to either total or partial stoppage. Again, the average householder is best satisfied when his faucets run like soda fountains. Also the water committee, Board of Public Works, or what not, under whose direction the water supply is constructed and maintained, is apt to be infected with the profound and ineradicable impression—supposed by them to contain much professional wisdom—that much head is a good thing and more head is still better. Which proposition so far as it relates to water committees, is undeniably true.

It is thus evident that public opinion is decidedly in favor of high pressure; and it is not strange that engineers who design water supply systems and contractors who construct them, should aim to satisfy this demand. Fire streams thrown so many feet high, faucets whose flow fills pitcher or glass in a twinkling, hydraulic motors and elevators which don't weaken,—these are evidences of the efficiency of a water supply which every one can appreciate. The interest on cost of plant and the expenses of maintenance, however, are things which the mass of the voters know little about; and although they probably regard the water rates as an unjust and exorbitant tax to be evaded if possible, they fail to discover the relation between the high rates and the elevation to which the water is pumped.

It is a fact not generally understood, that under the conditions which obtain in a majority of our smaller cities and towns, viz; water forced into mains by pumping and unlimited supply to pumping station, the pumping expenses of the department vary directly with the head against which the pumps work.

The average citizen does not realize that ten gallons of water delivered at a pressure of ten pounds costs no more than one gallon at a pressure of a hundred pounds. Of course the difference in duty between an engine working against high or low pressure, comes in to modify this; but the result in practice will nevertheless approximate to the theoretical.

Nor is this the sole advantage of the low pressure over the high. If the latter is superior in the matter of stoppages, there are plenty of bursts to offset it. In general, the low pressure has far less leaks in mains, service pipes, or plumbing fixtures, and those which it has lose a much smaller amount of water. Thus the vexed question of water waste is much easier of solution in the low pressure system. Finally in case the pressure is not to be increased for fire purposes, the whole plant of the department may be made much lighter and cheaper.

It is thus evident that in the original design of a water supply, the low pressure system should have its many points of advantage carefully considered, and the particular circumstances of the case will decide whether its use is warrantable.

But a more important matter now claims our attention. Most of our American cities are already supplied with water works; and the question is, how the advantages of the low pressure may be gained for the departments already existing. As regards a reduction of pressure throughout the whole area supplied, the reservoir systems must of course remain as they are; and in the stand pipe and direct pressure system, while the pressure, may sometimes be lowered, the limit will in most cases soon be reached where complaint will be made of insufficient pressure in the higher parts of the town.

But there is a mode of utilizing the low pressure system that is of interest to every department save those which have an unlimited gravity supply. I refer to the use of "low service" or "low pressure service" system. Let us take a typical eastern city of from 4,000 to 100,000 inhabitants, and examine its topography. First, we generally find it situated upon some river or lake which may be made to furnish an abundant though often impure supply. This may or may not be the source of the existing supply. At no great elevation from the water are located the factories, mills, railroad buildings, steam boilers etc.,—the manufacturing district. Next above this is the thickly settled residence and business portion of the city, and on the highest elevations the residences and grounds of the wealthy, supplied often from a "high service."

Now, of all the demands upon a water supply, one of the very heaviest is that made by the various manufactories, many of which are obliged to use very large quantities of water in their various processes, and still cannot afford to pay what the water has actually cost the department. Before the days of meters, such manufactories were often a heavy drain upon the resources of the department, and one whose source was often unsuspected. Since the general introduction of the meter system for large consumers, even when the rates have been placed at the lowest affordable limit, these manufacturers have often found it more economical to establish a "low pressure service" of their own, pumping from the river or an artesian well, than to pay meter rates.

Now in such a case as I have cited, is it not a great waste to deliver the large amount of water which this manufacturing district requires, at a pressure of from 80 to 150 pounds when 10 to 25 pounds would do as well. In such a case, I would propose to make of the manufacturing district a low pressure service, at the least possible expense, by a method of which the main points might be briefly outlined as follows: Provide enough additional stop-valves that the mains of the given district may be cut off from the rest of the city and from the pump supply. Provide a pumping engine for supplying this low pressure service, and let it pump directly into the mains, with a small stand pipe for regulating the supply. A stand pipe for low pressure need not be expensive. In nine cases out of ten, it would be desired to rely on the hydrants pressure for fire streams. Therefore, in case of a fire alarm from the "low pressure district," the engineer in charge of the low pressure pumps would shut off steam, close a gate cutting off his engine and its stand pipe from the mains, and open one or more gates connecting the low pressure mains with the upper service.

In case of accident or repairs to the low pressure engine or its stand pipe, or in case of any unusual demand in the low pressure district beyond the capacity of the engine to supply, the same change would be made. Hence the precautions of extra weight, strength, capacity, or duplication of parts, usually provided in hydraulic machinery as a safeguard against failure of the supply, would in this case be unnecessary, and the engine would be comparatively inexpensive.

This plan involves no additional fire risks; for in case of accident to one of the stop-valves connecting the low pressure mains with the upper service, another gate could be opened. If the mains and plumbing fixtures of the manufacturing district were all in good order, it would be advisable to run the low pressure engine only during working hours, and at other times leave the mains in connection with the upper service, thus avoiding any possible delay in case of night fires.

Of course where a department has already an ample supply for all demands, there are few water boards who would be willing to undertake the expense of alterations and innovations for the sake of economy. But when existing works are outgrown and the question of extension comes up, it is submitted that a marked economy may be achieved and the expense of extensive additions avoided by the establishment of a low pressure service.

Death Rate of Mexican Cities.

In the *Mexican Financier* of July 10th and 17th, Civil Engineer C. H. M. Blake, formerly of Pawtucket, R. I., discusses at some length the sanitary condition of Guanajuato, Mexico. The arguments naturally consider the general principles of sewerage with especial reference to the climatic conditions and local circumstances of the city to be sewered. Considerable space is given to the comparison of statistics of various American cities. The sanitary condition of Guanajuato is shown by the following table:

City.	Population.	Annual deaths per 1,000 of population.	Number of years in which the deaths equal the population.
Guanajuato...	53,000	76	13
Mexico.....	300,000	50	20
New York.....	1,206,299	22	45
Brooklyn.....	644,526	19	53
Baltimore.....	408,250	22	45
St. Louis.....	400,000	20	50
Boston	412,000	22	45
San Francisco	234,000	20	50

Mr. Blake adduces another table to show the beneficial effect of the proposed improvements:

Fortunately sufficient statistics are accessible to prove, beyond doubt, the beneficial effects of water-works and sewerage on the health of a community.

One of the most striking instances of reduction of death rate, attributed to an efficient sewerage system, is the present healthy condition of London, England.

Two centuries ago London had an annual death rate of 80 per 1,000, about the same as Guanajuato at present. To-day the death rate, with its dense population, is but 21½ per 1,000.

In the following table ample evidence is given of the wonderful improvement in the health of the places referred to, all being English cities or towns.

Place.	Reduction in deaths from typhoid fever per cent.	Reduction in deaths from phythisis, per cent.
Bambury.....	48%	41%
Cardiff.....	40	17
Corydor.....	64	17
Leicester.....	48	31
Macclesfield..	48	21
Merthyr.....	60	11
Salisbury.....	75	49
Warwick.....	52	19

As typhoid fever is one of our most prevalent and fatal diseases, the above statistics should be of interest to our residents, Guanajuato to-day being in a much worse sanitary conpition than any place embodied in the above table, the percentage of life saved, if sanitary improvements are made, from zymotic diseases, would be much greater than in any of the cities mentioned.

If a well designed plan for the water-works and sewerage were carried out, with the details of construction carefully executed, the annual deaths in Guanajuato should be reduced from the present alarming rate of 74 per 1,000 to not exceeding 20.

Canadian Government Surveys.

(Continued from Page 82.)

III.

BY D. L. S.

Written for ENGINEERING NEWS.

When the party is finally made up the men are generally divided into two gangs, containing, if on a transit line, from three to five axemen, if on a compass line two or three, besides two chainbearers for each gang.

There will generally be a couple of men be-

PICKET MAN AND BLAZER.

sides the cook who are not at work on the lines. These will be required to keep the supplies within reach of camp as the works progress. But on camp-moving days, (which occurs on an average about once a week) it is advisable to let every man help by harnessing himself in a thump-line and carrying at least one load to the camp-spot.

One axeman in each gang will be chosen as picket-man. His duties are to watch the signals

MARK!

from the instrument, to keep on line, so as to give axemen behind a point to work towards, and to plant the pickets when the time comes to move on to a new station. A good man for this work is very necessary on transit lines, but on compass lines it does not make so much difference, for good lines are often run in open bush by the compass-man keeping ahead of the rest, setting his instrument at some point already found on the line and selecting some point in front such as a tree or stump for his next station.

Another axeman will be made blazer. He must mark the line by slicing off pieces of wood from the trees nearest which the line passes. The chainmen must note the lengths of all lines, and the position of important features, make and plant the posts, and keep near enough to the instrument to give notice when a corner is reached. On all transit lines, and on compass lines in six-mile townships, (where only a single row of posts is planted) they can do the blazing.

The Surveyors will run the lines, keeping notes of timber, soil, etc., as a check on the

TAKING AN OBSERVATION.

chainmen, and will take observations on sun or stars, sufficient to insure correctness in the direction of the base lines, and in the magnetic variation at the place of survey.

There is seldom anything exciting about the the ordinary work on a survey. To-day's work is much what like to-morrow's will be. Up at

BREAKFAST!

sunrise or thereabouts to a breakfast of baked beans, pork, bread and bitterly strong tea. Then after filling the handkerchief or small bag used for carrying lunch (generally called a "grub-bag") away through the gray, damp woods to the place where the line is to be run. Then along the line through hardwood and swamp, brulé and windfall, chopping and shouting for four or five hours, till about noon, when we stop by the first pool, or stream, or spring, or wet swamp, or wherever water can be procured, and munch our bread and pork, then light our pipes, and, after an hour's rest, off on the line again, stopping when the sun shining red through the tree trunks instead of gleaming among the leaves, shows that the time for work is up.

When we reach camp the sun is down, so the cook's bright fire seems cheery and the steaming pails of tea and bean-soup very comforting. After an inward application of these and a pipe by the camp fire, we tumble into our tents onto a bed of blankets spread on balsam branches, and sleep as hard as possible till morning.

This description of a day's work is correct enough so far as it goes, but it is not the whole truth. Nothing has been said of these little drawbacks which, occurring often as

APPLYING THE TAR AND OIL.

they do, make life on a survey by no means always pleasant.

First among these annoyances comes the poisonous insects—mosquitoes, black flies, sand flies or midges, deer flies and gallinippers, spiders, wasps and hornets. And besides all these, which have a right to be in the woods, their native place, it very often unfortunately happens that insects of a more disgusting kind (disgusting because generally associated with dirt) are imported into camp by some members of the party.

Of all these, the two first mentioned are the most persistent tormentors. They begin work in May and stop any time in October—the mosquitoes working day and night throughout the hot weather.

We have tried many ways of keeping them off but have found none so effective as a mosquito-proof tent at night (that is one with overlapping entrance and a long curtain that can be tucked under the bedding), and a mixture of tar and oil applied to the face and hands during the day. This is not particularly becoming, and is somewhat sticky, but one soon gets used to it, and it may be washed off at night. No one who has not been in the backwoods in summer can form a true idea of the numbers and the poisoning power of these insects.

On a survey in 1882, two of our chainmen had their heads and faces, their bodies to the waist, their arms to the elbows, and their legs to the knees, thickly covered with sores caused by the festering of mosquito and black-fly bites.

In our diary for August 21, 1884, is the following: "The poisonous flies, which have troubled us more or less ever since we came here, were worse than ever to-day. Though I was smeared with tar so that they could not bite me, they came about in clouds as I stood at the instrument. I actually inhaled some of the beastly things. They crawled into my ears, into my nose when I breathed, and into my mouth when I opened it to shout to the men. Black flies are sweet, but mosquitoes insipid in flavor."

Sand flies occur only in certain localities, and they are most troublesome at night. Their bites give one the sensation of having very sharp red-hot needles pushed gently into the skin.

Wasps and hornets generally begin to thrust themselves on one's notice early in autumn. Then they will be found by unwary

axemen in holes in rotten stumps, or in their grey paper-like nests.

Another constant source of discomfort is the wet. The day following a rain is almost as wet in the woods as the day when the rain is falling, for every blow of an axe fetches down a shower from leaves and branches. Then it

HORNETS!!!

must be remembered that tents, blankets and clothing, once wet, take a long time to dry, as there is little chance of spreading them in the sun. The feet are almost always wet, for scarcely a day passes when a swamp or a beaver-meadow has not to be crossed; and the ordinary foot-gear is a pair of cow-hide moccasins (called shoe-packs or larrigans) worn over woollen socks, which though light and comfortable, do not seem to exclude the wet. Sometimes too, streams have to be crossed by wading, when no trees can be found near enough and long enough to bridge them over. All this is very well in hot summer weather, but late in the fall when the water is ice-cold and when there is a thick hoar-frost in the mornings on the long grass of the beaver-meadows, this continual bathing might be comfortably dispensed with.

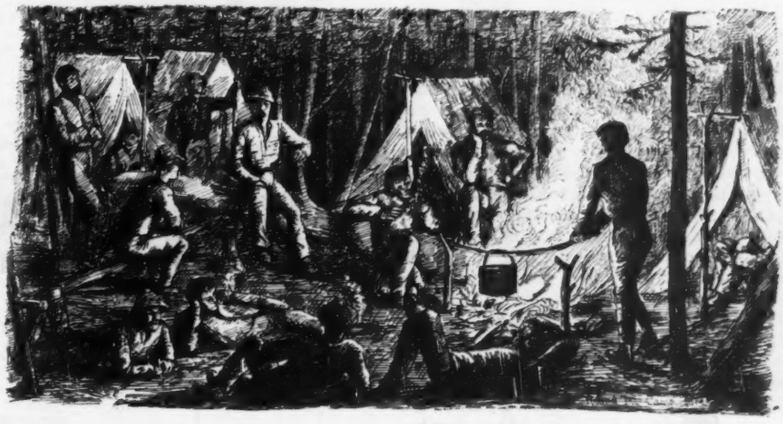
Strange to say all this wetting and chilling does not cause sickness at the time as would be expected, though when the work is over, with severe cold about a week, surveyors, like raftsmen, are very liable to be afflicted after beginning to sleep in a bed again. The most common forms of sickness are stomach complaints and blood-diseases caused by unwholesome eating, and occasionally mumps.

Another exceedingly unpleasant thing is to be left out after dark in the woods far from camp. During our first season in the bush we had two experiences of this kind with our whole gang. The first time was when the line struck a small winding river and followed persistently along its valley for half a mile or so, crossing the river itself seven or eight times in that distance. Of course we got wet through, having to wade the river every time, while the thick alders that almost invariably grow near the streams, so delayed us that it was nearly dark when we reached the end of our line, two and a half miles from camp. So, rather than re-wade the stream by star-light, we built a huge fire and slept by it all night, correcting our line in the morning and reaching camp at noon, after a twenty-four hours' fast. Another occasion was when a line was run to a point three miles from camp to join in with a township already surveyed. We could find no trace of the boundary after searching for an hour (it was found next day planted ten chains away from its proper position), so we started back for camp, but before getting half way there it had grown pitch dark, so that we could not even see the fresh blazes. We actually had to feel our way for over a mile, holding on to the last blaze till another was found, and striking matches and lighting bark torches occasionally when blazes and stumps were scarce. When we had groped along in this way for a couple of hours—scratching our faces on outstretched branches and barking our shins against fallen logs—we reached a tamarac swamp at the other side of which we could see our camp-fire blazing—a sight that made us move along as if it were daylight, regardless of the holes full of black mud into which every now and then a foot or leg would be thrust, and withdrawn with an execration. (This execrating, by the way, is a sin very prevalent on surveys, but it is very hard to forgive the seventy times seventh bough when four hundred and eighty-nine others have switched you across the face, or to refrain from breathing a hearty curse on the log whose deceptive rottenness has let you into a bog).

Another cause of delay and annoyance is the breakage of instruments. We once lost over a week's work for a whole gang by an accident of this kind. A compass glass was broken, and, as there were no spare ones in camp, the instrument was rendered useless

THE NOON DAY MEAL.

The only way to repair it was to go to Mattawa—a distance of fifty miles. So the assistant and one man started early one morning to get a new glass. This was on the 18th of July. That evening they reached a tent where we stored provisions at the head waters of the Amable du Fond, a considerable stream tributary to the Mattawa. Here they expected to find a canoe or the Indians, whom we employed to bring provisions up the lakes. Neither being there, and a heavy thunderstorm coming on, they tumbled in to sleep among the bags and boxes, accompanied by hosts of mosquitoes. To make matters worse for the assistant, the man with him was an inveterate snorer, so what with the mosquitoes and the thunder, and what with rousing himself every now and then to throw shoe-packs and shanty-biscuits at the man at the other side of the tent, the night was somewhat tedious.



ROUND THE CAMP FIRE.

FORDING A CREEK.

The next day, and the next, and part of the next the rain continued, and they stayed at the tent preparing their meals in an empty tomato-can, their only cooking-utensil.

Late in the afternoon of the third day, the Indians came with two canoes. The same evening they paddled nine miles to the shanty of the Indians, which lay on the route to Mattawa, and passing the night there, went on next day by canoe to Hindman's farm—an extensive clearance far removed from any other, where twenty-five men and twelve teams of horses were employed in raising hay and oats for the shanties, Hindman being a lumberman. A walk of seventeen miles thence along a rough wagon track brought them to Mattawa. Here the compass glasses and some other necessaries were soon purchased, and two Frenchmen were hired to work on the survey. Next day (Sunday) the four walked back to Hindman's, and the Frenchmen got drunk on the way by means of a can of whisky, which they stole from a shanty on the

OUT AFTER DARK.

road. On Tuesday morning they took the canoe again, and paddled and portaged to the Indians' shanty, but a high wind on the lake prevented their going further. The residence of the Indians was built near the lake, surrounded by a clearance of perhaps thirty acres, which was cultivated after the Indian fashion—that is, not half cultivated. The buildings were of logs, roofed with cedar scoops, bark and hand-made shingles; the boards comprising doors, flooring and furniture having been hewed out with axes. There was only one room in the house, with a table, two benches and a number of beds built like berths round the walls. The inmates were three Indians, an old squaw (the wife of the eldest of them,) a little boy, and six dogs.

THE SQUAW AND HER BOY.

The squaw who could not speak a word of English, was quite a talented person, and exhibited with much pride two drawings of her own—one of a moose from nature, and another of two impossible white women, apparently copied from some old fashion-plate. Her little boy carried wood, paddled in the water and played with the dogs, all day. He was very black, with an exceedingly flat face having all the profile crushed out of it.

In this shanty they stayed, feeding on moose meat, and potatoes and onions from the garden till the evening of the second day, when the wind fell, and they embarked again and paddled to the provision-tent. It was on the evening of the twenty-sixth of July, after an absence of nine days, that they reached the main camp. (And by-the-bye, it was only two days afterwards when the two Frenchmen brought in, with two others who had been employed for some time on the survey, took French leave and skipped for Mattawa, whither we had to follow them to hire new men.)

THE INDIANS' CLEARANCE.

These are some of the most ordinary annoyances to which surveyors are subjected; but the man who is suited for the rough life can find pleasures in it which make up for these pains. The tangled swamp often leads to the open cranberry marsh or beaver meadow, bright and sunny, surrounded by feathery tamaracks, where the line can be run as fast as the chainmen can measure, and where huckleberries can be picked by the handful as we walk along. The brulé and windfall are covered in places with raspberry-bushes which bear fruit luscious enough to tickle a surveyor's palate without the addition of cream and sugar.

INTERIOR OF INDIAN'S SHANTY.

Sometimes the line runs into a lake, lying

RUNNING THE LINE OVER A BEAVER MEADOW.

bright and calm in the sunlight, covered with wild fowl, surrounded by woods, and with it banks in soft places beaten down by the hoofs of deer and moose. Perhaps, if we approach quietly we may see a huge bull moose and his mate standing in the water and flapping their long ears at the flies. Or our line may run by a stream where beaver live, and we hear the splash as one of them drops into the water and we see their wonderful dam and the trees six to

THE SQUAW'S DRAWINGS.

twelve inches through, gnawed down by their strong teeth.

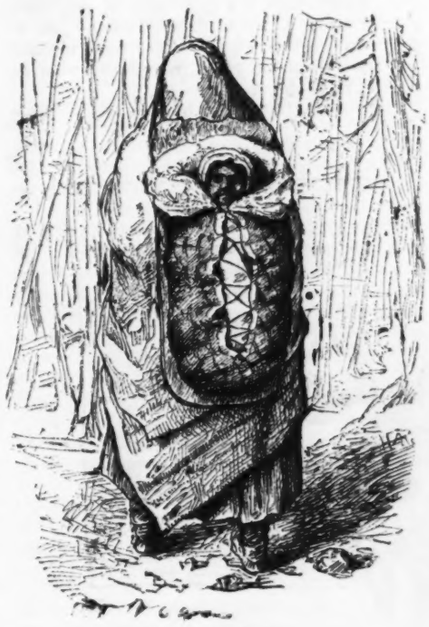
Or it may be we pass a portage between two lakes, and meet a native with his canoe, his squaw following him with her papoose on her back tied to a board carried by a strap round her forehead. And then there are the evenings in camp—the huge camp fire and the tents pitched near it among the dark trees and the lake close by where the loons are howling and laughing in the moonlight, and the Sundays, when as a rule no surveying work is done. Some of the men wash and mend their clothes, some go for a swim or to fish in the

A NATIVE.

nearest water. The cook only gets no rest, for not only will he be expected to prepare the ordinary morning and evening meals, but also to provide some special delicacy for the midday meal—raspberry or huckleberry pie, or boiled pudding compounded of flour, pork grease, baking powder, sugar and raisins.

The appetite for food created by the regular exercise and the fresh air is something remarkable. We once made a calculation of the amount of food eaten on a survey. Taking an average of four seasons, it was found that the amount of uncooked food consumed per day was about four and a half pounds for each man. What amount of food in a state fit for eating this would make was not calculated; but considering that the four and a half pounds includes such things as flour, oatmeal, rice, dried apples, etc., which increase greatly in bulk in the form of bread, porridge, pudding, or sauce, we are afraid that about one-half must be added to this computation, and that each man may be credited with a capacity to demolish at any rate six pounds of solid food daily.

After working and living in the way we have tried to describe for some time (four or five weeks if the township be six miles, ten or eleven if it be eight and three quarters miles square) the field work draws near completion. Then the biggest days' work will be put in, for not only are the men by this time well up to their work, but that they are going out seems to put new life into them. Even the old men and the shirks will do their best,



ON THE PORTAGE.

and on the last day, when the last post has been planted, the surliest face in camp will brighten up and wrinkle into smiles. The men will gather round the cook's fire, and talk over the troubles and disasters of the season, and swear by great oaths never to be seen on a survey again. But in all probability these same men would be found next year ready to start to the woods, for the life in spite of the

RAFTING TOWARDS HOME.

hardships, has a fascination for those who are suited to it, that is hard to resist.

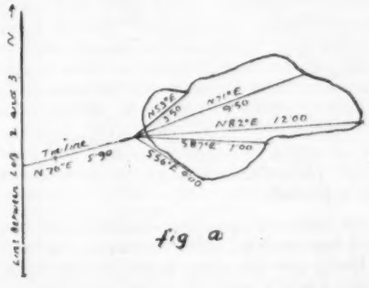
Now the work of packing out to civilization begins. If the surveyor has estimated the quantity of supplies rightly, this will not be hard to do, for everything that is left can be carried out by loading the men with a pack each. An exceedingly tough looking set the members of a survey gang are when the work is done. They go in looking (most of them) quite spick and span in their new flannel shirts and duck trousers; they come out (many of them) with just enough on to preserve decency—a little more clothing on the legs than a Highlander, and a little more on their bodies than a fashionable lady in evening dress.

AFTER TWO MONTH'S WORK
(Drawn from Life.)

When the place where wages are to be paid is reached if the money is forthcoming, the tents are pitched or the men are taken to the Surveyor's hotel and the paying off takes place. This is

PAY-DAY.

not alway a pleasant piece of business, for there are very often kickers who grumble at being docked for lost time, or at receiving the wages they agreed to work for, when others



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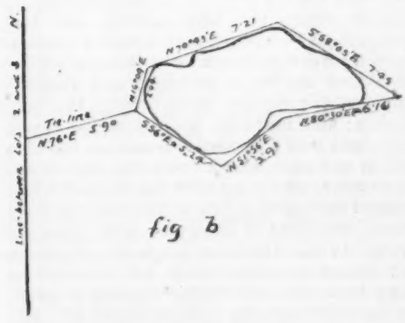


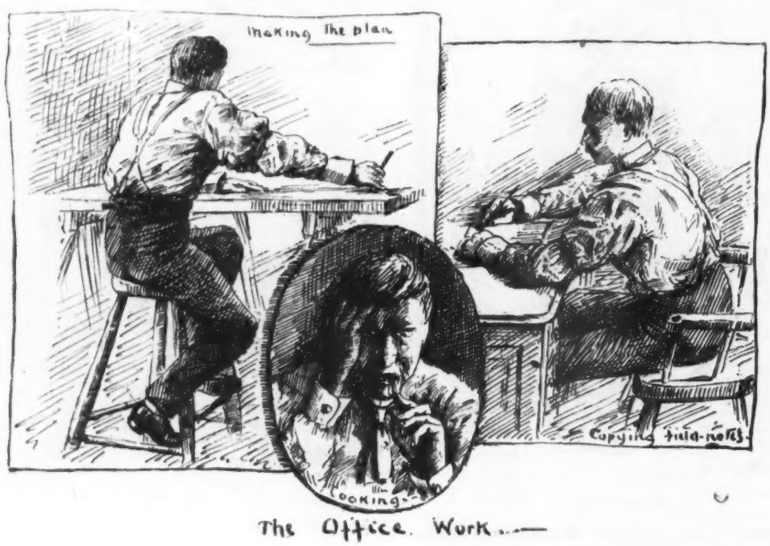
fig b

(who in their opinion are no better men) receive more. It is by no means desirable for the surveyor to have to bandy words with men who are the less reasonable, the more ignorant they are.

Directly the bills are settled the majority of the men generally proceed to lay out their money at the bars, and not many hours after

wards may be found, gloriously or stupidly drunk, scattered about the village.

And now the surveyor bids farewell to the backwoods for a time, and travels home where there is still a good deal of work in connection with his township for himself to do. He must copy all the chainage notes into books to be filled by the Crown Lands Department—no easy task if the chainmen have been careless or incompetent. He must make plots of traverse of the waters in his township from his own notes and those of the assistants. We have reason to believe however, that traverse notes as sent in to Government are not always exactly like the original notes. For instance a lake might show in original notes some-



thing like Fig. *a*, but in final notes it would have the appearance of Fig. *b*. A little more trouble taken in the field would save a large amount of "cooking" in the office, and would dispense with the conscientious qualms some surveyors must feel when they make oath to the correctness of their returns. The chainage notes and the traverse will be entered in one book, in which will also be written the report on the township. Then a plan must be made according to instructions, and the field book and plan will be sent to the department for its approval.

If the surveyor has been careless or has trusted too much to office "cooking," he will very likely see his notes again before long, and with them a letter from the department, asking—where the bearing-trees are that locate posts so-and-so; and why the posts at such a corner is shown to be tamarac on one page and maple on another; and what becomes of the stream which crosses this concession; and how high the hill is that lies in that; and why a swamp is found on top of a hill on one page, and a creek running up hill on another; and some lake has no outlet, and some of the bearings of the traversed lines are wrong, and some of the areas on the plan are wrong; in fact, there are whole lists of errors and omissions which must be corrected or filled in before the final settlement is made. So the surveyor sets to work again and fills in the omissions, and as to the errrors—sometimes he owns his faults and is forgiven, and sometimes (alas!) it is to be feared he corrects his mistakes from calculation, memory or imagination. But the errors are usually unimportant so no one is likely to be hurt by his want of honesty except himself.

When the returns are accepted the balance of the account against the department is fully paid. The amount of money received by the surveyor in return for his services is by no means large. A small township is worth about $1,600; a large one, $3,500. The wages, provisions, traveling expenses, office work, etc., have cost from $800 to $2,000. So, supposing no extraordinary mishaps to have befallen him, if he has had a small township he has worked six or seven weeks and gained from $400 to $800, if a large one, he may have gained from $1,500 to $2,000 in from ten to fourteen weeks. At the same time he may have lost a considerable part of this sum by neglect of his home practice.

From what is written here it will be seen that government surveying is not a lucrative profession, though it has much improved in respect to the amount of money made by it as in all other points. It is to be feared, too, that there are members of the profession whose conduct and attainments tend to lower it. Still there is no doubt that it has much improved, particularly of late years; and we believe that the formation of the Dominion Association and of the several provincial associations, is the beginning of a movement that will in the end raise surveying to the rank it deserves to occupy among the professions.

The Yokahama Water Works.

The first water works to be built after modern plans in Japan, are now in course of construction at Yokohama.

The water is to be taken from the Sagamigawa river at a point twenty-five miles from its mouth, and 355.5 feet above mean sea level at Yokahama. As the fluctuations of the river level vary as high as 20 feet, engines are here employed to raise the water above the highest level to a tank 32 feet up the hillside, from which it runs by gravity twenty-seven miles to the reservoir on Nogeyama Hill, where also it is passed through filter beds before being distributed. The depositing tank at the intake above referred to, is 210 feet long by 8 feet wide, discharging at its further end over a wide notch-gauge into a small clear water basin 8 feet by 10 feet, the normal height of the water surface in this basin being 408.6 feet. The depositing-tank is introduced as a means of clarifying the water during these periods of turbidity when it may be necessary to continue pumping. It will always be possible to stop pumping for two or three days at the worst stages of turbidity, as the reserve in the reservoir and filter beds on Nogeyama will keep the town supplied for that period. The depositing-tank will fully meet the rest of the difficulty. Experiments made with water taken from the river when most turbid, and allowed to settle in a position of rest, have shown that at a depth of one foot, it is sufficiently clarified in about eighty minutes to allow of its being safely admitted into the pipe-conduit leading to Nogeyama; and the cross-sections of the depositing-tank has been so designed that the pumped up water shall take at least 100 minutes to traverse its length, 210 feet, the small velocity (about 2 feet per minute) thus nearly coinciding with perfect stillness. In these 100 minutes the water will become sufficiently clarified to a depth of at least a foot, which is ample to include the depth of the stream over the notch (about 4 inches) and the up-draft in its close vicinity. To the notch gauge will be connected an automatic apparatus, constantly registering on a revolving cylinder driven by clock-work the level of the still water just above it. By means of this register, the quantity of water delivered by the engines and passing over the gauge will be ascertainable at all times.

The engines and pumps are being made by Messrs. Hathorn, Davey & Co., of Leeds, England, and consist of a pair of horizontal compound surface-condensing engines, with cylinders of 12 and 20 inches diameter and 27 inches' stroke, performing 25 revolutions per minute, and actuating double-acting piston pumps of 16 inches diameter, and 27 inches stroke; their capacity is 1,296,000 gallons per day.

The conduit, of cast-iron pipe, supplied by R. Laidlaw & Sons, of Glasgow, is 18 inches diameter for 18.1 miles, and for the remaining 8.9 miles is 15.5. The total fall from the intake is 242.7 feet, the water level at Nogeyama being 165.9 feet above mean sea level. For the first 18.1 miles the gradient is 6.4 feet per mile, and for 8.9 miles it is 14 feet per mile. The point where this change of gauge takes place is on the summit of the height of land, above Kami-Kawai, which separates the basin of the Katabiragawa from that of the Sakaigawa. A junction-tank, or "Bubbling Well," will be introduced here, with valves to govern the passage of the water.

For the purposes of the works, the whole line is divided into three sections. The first under the superintendence of Assistant Engineer Tsuchida Tetsuwo, a graduate of Tokio University, is by far the most critical and difficult of the three. Throughout its length the river flows in a deep cañon on the outskirts of the Buso Sakai Mountains, in a tortuous and highly inclined channel, beset by a quick succession of rapids, and hemmed in for the greater part of the distance by steep wooded or rocky slopes, which here and there pass into dangerous cliffs rising almost vertically from the water's edge. The line is, however, very straight, and with the cheap labor of the country, a road averaging 8 feet wide is to be built along the line over which the conduit will be carried. To preserve the straightness of line, about one mile of tunnel will be excavated and some bridges erected. At the end of this seven mile section the conduit is 211 feet above the river-bed, difference of 158 feet from that at starting.

Section 2, under charge of Assistant Engineer Yamazaki Gentaro, also a Tokio graduate, is 11.1 miles long to Bubbling Well, and is the easiest of the three sections.

Section 3, under charge of Mr. Saito Kuishui is 8.9 miles long to the Nogeyama reservoir. On it are 1,050 feet of bridging, several steep gradients and deep cuttings, and the line runs for three miles through rice land, in which the

work of pipe laying is generally about as dirty and unpleasant as can well be imagined.

The water is delivered into a "valve-well" on the highest point of Nogeyamo, 165.9 feet above mean tide level; thence by an 18-inch pipe with 13-inch branches, the water is conveyed to the filter-beds, three in number. The filtering section is designed as follows: 3 feet of water will overlie 2.5 feet of washed river sand, under which will be 7 in. of washed river gravel, its particles increasing in size upwards from that of coarse grit at the top to small pebbles at the bottom; below the gravel the water will pass through the interstices of a course of bricks laid dry into a series of small transverse brick drains leading into a central main longitudinal stone drain, connected with the 18 inch clear-water pipe by which the filtered water is to be conveyed to the service reservoir a little distance away All of the pipes and other arrangements about the filters will be provided with the necessary valves to regulate the admission and exit of the water, with branches for ventilation, overflow pipes, and waste-branches for emptying the beds when required; and there will be provision for passing the water direct into the reservoir, without filtration, when occasion may suggest or require it. Each bed has a filtering area of 70.1 feet by 120.1 feet, and is designed to pass the water at a minimum rate of 12 feet vertically in 24 hours, which corresponds with a total delivery, for two beds, of 1,260,000 gallons per day, *i.e.*, as much as is likely to be required for some time to come. The floor and body of the walls are to be of cement-concrete, the walls being faced on the interior with rubble masonry, above the sand-level; and the whole structure will be enclosed in a bed and backing of well-tempered watertight clay puddle, an excellent material for which has been obtained from clay-beds near Yokosuka.

The service reservoir measures 190 feet by 144 feet on its floor, and has, with a depth of 18 feet of water, a capacity of about 3,154,000 gallons, or two and one-half days supply for 70,000 people. Like the filter-beds, it is to be a half-sunken structure, and to have a floor of cement-concrete and walls of the same material, the latter, however, being faced on the inside with brickwork, from the floor up. The works in Nogeyamo are in charge of Mr. Sheburga Kirjotu, graduate of Kobu College.

An inlet-well connected with the reservoir will receive the clear water from the filter-beds, which will be made to rise and overflow into the well from a vertical stand pipe, the top of which in its normal position, will be one foot below the level of the water in the filters, *i.e.*, 164.6 feet above the datum. That difference of one foot has been found, by careful experiments with the Sagamigawa water, to be the fall necessary, under ordinary circumstances, to secure the required rapidity of filtration. But a difficulty arises here, in consequence of the varying degrees of clearness of the water coming to the filters from the Sagamigawa, and therefore of the varying rate of filtration should the fall from the filters to the inlet-well remain a fixed quantity. But, as it is desirable that the volume of water entering the reservoir shall be of constant or nearly constant amount, the Superintending Engineer proposes to ensure this regularity by the novel device of making the stand pipe in the inlet-well telescopic, so that it may be lowered and raised at will. This plan will not only meet all difficulty of the kind referred to, but will admit of a very considerable increase of the speed of filtration (the standpipe having a play of 2 feet) in emergencies, such as a great fire or any other cause, which may have created a sudden and abnormal draft upon the reservoir. It will also meet all irregularities arising from different states of cleanness of the surface-sand. The ordinary top-water level of the reservoir will be 164.6 feet, but the water will usually be a little below that level, seldom however falling below 160 feet.

Besides the inlet-well, with its valve for regulating admission to the reservoir, there will be an outlet-well near it on the same side, for controlling the exit into the principal town main of 18 inches diameter; and the two wells will be connected by a special pipe, ordinarily kept closed, but available for passing the water direct to the town, without entry into the reservoir, whenever, for cleaning purposes or any other cause, such exclusion may be necessary. The reservoir will be fitted with a combined over-flow pipe and waste-pipe for emptying it, the waste water of the whole Nogeyama system being conveyed into a watercourse at the back of the hill. As a provision against waste in the event of a burst in the town, a self-acting throttle-valve will be inserted in the main a few feet from the outlet-well. There is no intention at present of roofing the reservoir. The considerations which guide engineers on this point appear to be so highly favorable here that the necessity of covering is not anticipated. Lest, however, it should be found hereafter that, in spite of the depth of the water, its rapid flow through the reservoir, the purity of the atmosphere, and the precautions which will be taken against contamination during dust-storms, there is any risk or appearance of the water changing its character, especially during the hot part of summer, the structure has been made strong enough for the future addition if required. There are some authorities who hold that filtered water should never see the light until the consumer draws it, but there are more authorities, as good or better, who insist on no such refinement, except under extraordinary conditions which do not exist here.

There will be about thirty-seven miles of distributing pipe, 4 inches diameter; work was commenced on pipe laying May 11th under the direction of Engineer Mita Zentaro.

In the foreign settlement service pipes of lead will be laid directly into the houses as in Europe and America; but in the native quarters street fountains must be used, the Japanese domestic architecture not being adapted to these modern conveniences. Self-closing taps will be placed every 100 yards from which parties can help themselves. But tea houses, baths, hotels, etc., must have the water laid on directly into their premises.

Fire hydrants are to be placed every 300 feet, over the entire inhabited area of Yokohama. Deacon's waste water meter is to be a part of the system.

The general control and direction of the whole undertaking is in the hands of the Superintending Engineer, who also supervises every item of expesne, and is responsible to the Governor alone. Associated with him for administrative purposes is a highly competent committee, consisting of Messrs. Tanuma Ken, Chief Secretary of the Kencho; Mitsuhashi Nobukata, Director of the Foreign Department; and Tanino Toshi, lately Director of the Engineering Department. In technical supervision he has the valuable and zealous aid of Mr. Mita Zentaro, Chief Engineer of the Kencho, who has been associated with the project from its outset, and of Mr. J. H. T. Turner, Assoc. M. I. C. E., as chief and only foreign assistant. A moderate but sufficient staff of accountants, clerks, interpreters, draughtsmen, store-keepers and inspectors make up the headquarter establishment. In the arrangements for the English contracts, the system followed was to invite, for each class of material, tenders from seven or eight firms of the highest repute. Sealed tenders were called for, in duplicate, to be sent to the Japanese Legation in London on the day prior to the Superindending Engineer's departure for Japan. One set of the tenders remained sealed in the Minister's hands, the other sealed set being brought out by the Engineer to Yokohama, where they were opened by Governor Oki, the awards, to the lowest bidders, being then telegraphed to the Minister. As for the outlay on the present undertaking, if the average prime cost (per eighteen gallons delivered daily) of English gravitation works supplying from one to two million gallons per day to be compared with the estimated cost of the Yokohama works (which will not be exceeded),—after reducing the latter by the amount of freight and insurance for imported materials—it will be found beyond all dispute that the figure for Yokohama falls at least 15 per cent. below the English average. This result—in the face of the facts that Japanese labor, though cheap, is unskilled in many departments of the work, that there is here a great deficiency of modern economical appliances, that the water has to be brought from a considerable distance, and that the enterprise as a whole presents natural difficulties of much more than average magnitude—affords ample proof that economy has been aimed at and secured, and should be sufficient to set at rest all doubts upon the question of expenditure. Any assertions or hints to the contrary can only proceed from blank ignorance or impudent attempts to mislead. It is charitable to hope that only the former of these disqualifications affected the eccentric person who lately was heard to declare that he "could do the whole thing for $200,000."—Condensed from the *Japan Mail*, May 24.

The Panama Canal.

From Herapath's Journal.

The report read by M. de Lesseps at the meeting begins by showing that the net expenditure from the beginning of the enterprise to the 30th of June, 1886, was 471,000,000f., and that the amount of shares and bonds is 712,000,000f., leaving a balance of 241,000,000f. 147,000,000f. of this sum consists of uncalled-up instalments on shares, 13,000,000f. of such instalments on bonds, and 81,000,000f. of other assets. After citing numerous authorities to show that a traffic of at least 7,250,000 tons and a revenue of 108,000,000f. may be counted upon, M. de Lesseps gives the history of his application for the sanction of a lottery loan, of M. Rousseau's visit to Panama, and his report, the tardiness of the Parliamentary Committee, and the substitution of an issue of bonds at 450f., repayable at 1000f.

The report then shows that the difficulties of the enterprises were at first deliberately exaggerated, the estimate being that 75,000,000 cubic meters would have to be excavated at a cost of 1,200,000,000f. But experience showed that the sides of the canal, being less rocky than had been imagined, might be made more sloping, the total to be extracted being thus raised to 110,000,000 cubic meters. It points out the mistake of judging of the duration of the works by the material already extracted, as the rate of extraction increases with the use of improved machinery and with the greater familiarity with the work. At Suez, with 75,000,000 cubic meters to be extracted, the excavation of 25,000,000 took eight years, and twenty years more were predicted to be necessary; whereas the remaining 50,000,000 were extracted in two years. At Panama, in like manner, the average monthly output has risen from 16,000 in 1882 to 215,000 in 1883, 617,000 in 1884, 658,000 in 1885, and 1,079,000 in the first half of 1887. Thus, with a monthly average of 2,000,000 meters in 1876, and 3,000,000 in 1888 and 1889, the 110,000,000 may be extracted and the canal completed by the 1st of July, 1889. Not a single dissentient voice was raised at the meeting.

PARIS, Aug. 6.—150,000 new subscribers have applied for the new bonds issued by the Panama Canal Company. The number has exceeded the most sanguine hopes of the company. M. de Lesseps has issued a new circular addressed to the shareholders in the Panama Canal. In it he states that over 100,000 shareholders have subscribed for 458,802 shares in the new loan. The Council of Administration of the Panama Canal Company have, on the proposal of M. de Lesseps, decided to annul all of the new shares not subscribed for directly by the public.

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WE will be obliged if the Secretary, or other proper official, of every Engineering School or College in the United States and Canada will, as soon as possible, send us a circular of their Institution, giving the course of study in Engineering.

We propose to make a careful review of these, and will be pleased to receive the co-operation of interested parties.

WATER WORKS CONTRACTORS are specially requested to remember the meeting of the National Association of Water Works Contractors at Saratoga on the 26th and 27th, advertised elsewhere this week. There is no doubt of a good attendance, and there is equally no doubt of an interesting and profitable convention being held.

A CORRESPONDENT at Mount Carbon, Fayette, Co., W. Va., wishes to know the Magnetic Variation for the years 1797 and 1857 for latitude 38°15′ N. and longitude 4°15′ W. of Washington, D. C. An answer is requested as soon as possible. In this connection we find from Stone's "Magnetic Variation" that the variation at Newbern, N. C., in N. latitude 35°20′, longitude 77°5′ W. of Greenwich in 1796, was 2°40′ E., in 1806 it was 2°0′ E. and in 1809 it was 1°45′ E.

THE Russian railroad to Merv, 497 miles from Michailovsk, on the Caspian sea, was opened on the 14th of June. It is to be immediately extended to Samarcand, 393 more miles.

The stations are from ten to fifteen miles apart, and though many of them are in the desert they are all supplied with water, at Machailovsk by Nōbel's machinery for distilling sea water, and, where artesian wells have not been put down, or have not proved effective by tanks supplied by pipe lines or water trains.

The Russians are jubilant over the strategic advantages the road affords, claiming that the rapid civilization of the wild tribes will enable them to make that country a base of supplies for an advance on Candahar, and already talk of a new Anglo-Russian frontier. It also seems pretty certain that they will control the trade of northern Persia.

Whatever doubt one may have of the advantage of their rule in India, every one must admit that they have been a great civilizing force in that portion of Asia they have occupied so far, and there are few who do not wish them a port on the Indian ocean, which may be their objective point instead of India.

ROLLIN M. SQUIRE and MAURICE B. FLYNN were indicted by the Grand Jury for misdemeanor on Tuesday. The indictment is a joint one, charging unlawful bargaining to obtain appointment under Sections 52 and 53 of the Penal Code and Section 59 of the Consolidation Act, and conspiracy to "to commit an act for the perversion or obstruction of justice or of the due administration of the law." The main charge is under Section 52 of the Penal Code, which says:

> A person who gives or offers to gives any gratuity or reward in consideration that himself or any other person shall be appointed to a public office, or to a clerkship, deputation or other subordinate position in such an office, or shall be permitted to exercise, perform or discharge any prerogatives or duties, or to receive any emoluments of such an office, is guilty of misdemeanor.

Both Squire and Flynn gave bail to the amount of $10,000 each. Their trial will probably come off in September. The examination of Squire before Mayor Grace continues. On Tuesday the poetical Commissioner related in somewhat dramatic and picturesque language, the story of the famous letter on account of which he is now under indictment. There is no denial of the authenticity of the letter, but Mr. Squire simply considers himself a victim of the treachery of the dead leader of the County Democracy.

The offence charged is punishable with imprisonment for one year and a fine of $500. Section 52, which is the section under which Squire will probably be tried, does not carry with it, as most of the sections relating to official misconduct do, a forfeiture of office as a penalty of violation. This is probably because the offence is committed before the applicant takes office.

Maurice B. Flynn was met by a reporter a few minutes after he had left the the District-Attorney's office. He was cool and collected. He said in answer to an inquiry whether he wished to say anything at the present time:

> I believe that the indictment was procured and enforced at the present time merely for the purpose of preventing Mr. Squire and myself and our witnesses from disclosing Mayor Grace's disgraceful connection with the conspiracy to get control of the Department of Public Works. I have confidence that the public will, after hearing the evidence to be presented by us, entirely exonerate both Mr. Squire and myself, and believe, as the fact is, that we are the victims of treachery and vile conspiracy.

The whole story of the bargain and sale of the most important office in New York City is an interesting chapter in the records of political crime. That an unknown individual like Squire could, in the waning hours of the administration of a revengeful old man filling the office of Chief Magistrate of this great city, suddenly put in a claim for a very important office, with the assurance of being confirmed,—and carry the day too,—is so marvellous that we do not wonder that in his evidence on Tuesday Mr. Squire "went on to say that when it was suggested to him that he could be nominated as Commissioner, he was not more astonished than if he had been told he could become the Czar of Russia."

His confirmation fully illustrates the purchasable character of the City Council of 1884, and the absolute control of the two worthies, Thompson and Flynn. The good-natured public were not considered of the slightest account in the administration of the important interests of the City Government. Mr. Squire is out on bail and while awaiting trial is in control of the Department of Public Works of this city.

Few men outside of New York have an idea of the power of the Commissioner of Public Works. He has the appointment of over 1,500 office-holders and the distribution of about $10,000,000 in patronage each year. He has the division of more spoils than the governors of all the New England States, and of more than the executives of New York, Pennsylvania and Ohio combined. Mr. Squire is also a Commissioner of the New Croton Aqueduct Board the recent reorganization of which is familiar to our readers, Thus another "sensation" is added to the political record of this year in the metropolis. The Vice President of the Board of Alderman is "doing time" at Sing Sing, a dozen or more of his associates of 1884 are awaiting trial, others are "exiles" awaiting events; new revelations of the most unprincipled rascality in high official places are daily coming out, and the whole political atmosphere of this city is so surcharged that even greater "developments" than any which have yet appeared are fully expected.

The Canal Convention.

It is said that an ordinary politician is one who sees the way the people are going and gets there first, but that an able politician sees the way the people think they are going and heads them off.

The approaching canal convention will probably contain, among others, politicians of both the above mentioned classes. There is no doubt of the powerful influence of waterways as described by Mr. Blanchard in his testimony before the Senate Committee on Interstate Commerce, "They (waterways) are the safeguards against railroad extension * * * and not only regulate the charges of carriers by rail parallel to them, but absolutely enforce the same limitations upon rail carriers that are remote from them, because, if a carrier by rail that is parallel to water makes water rates, another and more distant railroad cannot get more than its rival charges," and Mr. Fink, speaking before the Hepburn Committee, said with equal force, "It extends to every point of the country." "Thus the lake and canal navigation regulates the rate of the whole country, you may say, from Canada down to the Gulf. The maintenance of our trunk canals should engage the constant solicitude of the State. Nothing could be more prejudicial to the interests of the city of New York or the State as a whole than to permit their efficiency to be impaired or their usefulness compromised."

Nor is there room for doubt that the lakes, since the improvement of the St. Clair Flats and the deepening of the harbors, have afforded a much more efficient regulation than they would if the maximum capacity of

lake vessels was still 20,000 bushels instead of 100,000 as at present, and in our issue of May 22nd, we quoted the testimony of ex-State Engineer Seymour that enlarging the St. Mary's Falls canal from a depth of 12½ to 16 feet, saved to the port of Marquette alone in freights three times the cost of the improvement, within four years.

Yet on the question of the enlargement of the Erie canal, the representatives of an organization from this city will be found decidedly objecting to any scheme that proposes widening the locks or increasing the depth more than two feet, and they will derive support from the ex-State Engineer quoted above, who has seen the expense incurred in increasing the depth of a canal from 12½ to 16 feet, pay one town alone at the average rate of 75 per cent. on the total expenditure, for four years in succession, and still thinks that "the present boat, (6 feet deep) is as deep as can be made with safety." "The present boat (carrying 250 tons as a maximum), is as large as can be handled, or constructed with economy."

The forwarding interests of Buffalo may see with apprehension a plan that will obviate the necessity for transfer of cargoes destined for this city, and canal and river ports to the east of them, for until it is tried it cannot be surely proven that the cheapening of freights consequent on a radical enlargement of the canal will so increase the commerce and manufacturing of Buffalo as to give them more to do than at present, and they will naturally range themselves with the able politicians heading off any plan or proposition that looks to through freighting.

Mr. B. F. Thurber of this city, a man who is known to entertain decided views on the subject of transportation, asserted before the Senate Committee referred to above: "When a River and Harbor bill is pending in Congress, the railroad representatives will vote millions for improvements which do not materially effect them, but when it comes to an item like the Hennepin canal, which promises to be of value in extending our system of water ways, the railroad representatives whether Democratic or Republican, are found voting solidly against it." Mr. Thurber may be prejudiced; unappreciated efforts sometimes sour tempers that otherwise would have remained sweet; still if he is correct as to Congressional action we may see able politicians in other interests than those of the Buffalo forwarders and elevator men.

But we do not see why the merchants and shippers of New York should oppose a thorough enlargement of the canal or fail to urge that its depth be made equal to the probable future depth on the St. Clair Flats. They surely see how short sighted and foolish their fathers were in opposing Clinton's efforts to build the canal. They know that England in her effort to develop wheat fields wholly tributary to herself has guaranteed the interest on the capital invested in most Indian railroads, faithfully taking it out of the poor Hindoos when a rigid adherence to the purchase of English rolling stock, prevents the net earnings of the road paying the guaranteed interest, and they know that loans are floated in London that railroad construction can be urged forward in other colonies, where not being "crown colonies," it is not safe to guarantee interest with any idea of raising a deficiency by taxation; and that the argument used is, as in Mr. J. S. Jeans's paper lately issued in London: "It is of great importance to England to endeavor to assist the colonies to take the place of the United States in this regard," *i. e.*, their supply of grain, of which he asserted they buy $150,000,000 worth from us annually.

If we continue to sell grain in Great Britain, we must sell it cheaper. If the decrease in price received comes off from the farmer instead of from the cost of transportation, the farmer will have either to go out of wheat growing, or buy less luxuries; the first will interfere with the exports of this port; the second, with both the manufactures of the city and its imports, neither of which are desirable. In spite of their most strenuous efforts to improve the commerce of the city by cheapening the cost of transportation, they will find many able politicians heading them off as in the late case of the Hennepin canal.

The Manufacture of Rails in Canada.

According to a late number of *Iron* this question is now being brought forward with a view to its introduction in the Dominion. In 17 years of the confederation, ending Jan. 30, 1884, the invoice value of iron, steel, and manufactures imported for home consumption amounted to over $230,000,000 including over $48,000,000 for rails. This equals an average yearly expenditure of over 13½ millions. The consumption of rails, excluding those for the Canadian Pacific, shows an annual average of over 64,000 tons. *Iron* adds that the Canadian government derives no income from the importation of rails and we need not be surprised at the suggestion that if Canada were to manufacture all its own requirements of iron and steel, a great saving would be effected.

The Toronto Commissioner of Works and Health.

One of the Toronto papers has lately published a list of twenty-one engineers, who, it affirms, applied for the position of Commissioner of Works and Health. The list appears to have been surreptitiously obtained; the manner in which it was obtained is under investigation by the mayor. The paper takes to itself credit in making known the names, and rates the "ring" in the council who kept the names secret and excluded reporters from the meetings of the committee who received and considered the applications. We have no hesitation in endorsing the action of the Executive Committee and their Chairman, Alderman Defoe; they acted in strict accordance with the terms of the advertisement, and any publication of the names would have been a gross breach of faith. Any objections to the course taken should have been made as soon as the advertisement appeared and *not* after the names had been sent in. We believe we have the profession with us in saying this.

It is now proposed to advertise afresh, all applicants' names being published. We trust no engineers of standing and certainly that none in "first-class standing," will be so foolish as to put themselves into the position of applicants for an appointment which seems to be bandied between pillar and post.

PERSONAL

MR. D. MCN. STAUFFER, of this journal, arrives this day (Saturday) by the *Celtic* of the White Star Line.

WM. F. SHUNK, formerly Chief Engineer of the Metropolitan Elevated Railway of this city has been appointed Resident Engineer of the new Harlem river bridge.

J. E. DAWSON, Assistant Surperintendent of the Great Western Division of the Grand Trunk Railroad has resigned that position to accept the appointment of General Superintendent of the Montana Union R. R. His office will be at Butte, Mont.

ABEL HUOT, Government Inspector of public works, Quebec, has resigned and come to New York. Mr. Mathieu replaces him as inspector of works in the Militia department of the office. The public works branch is still vacant.

C. W. STANIFORD, Engineer-in-charge, is now locating a line for the Eastern South Carolina R. R., and has now finished 70 miles of line. The road is to run from Smithville, N. C., to Conway, S. C., thence via. Marion and Salisbury, to connect with the new road now building to Bristol, Tenn., in all about 300 miles.

A Fort Worth, Texas, dispatch says:

MR. J. M. REED, a civil engineer, has received his official commission from the government as assistant superintendent of construction of the Royal Trans-African Railway, to be built for the Portuguese colonies in South Africa. Mr. Reed leaves on the 10th for Brunswick, Ga., where he takes passage on the bark S. J. Bogart the 18th. He will be in Africa five years.

WM. LUST, formerly Resident Engineer of the New York Central & Hudson River R. R. has been made Chief Engineer of the St. Joseph and Grand Island Railroad. He is to have charge of all new construction, and such other work as may be intrusted to him, and will report to D. McCool, General Manager. The Grand Island has never had a Chief Engineer before, and Mr. Lust is appointed to take charge of the feeders the line has under way. The company now has a small army of engineers in the field locating these lines.

SOME time ago an American wag wrote an account of a gelatine shirt that Edison had invented; it was said to be made of thin sheets of gelatine, each sheet to be taken off when soiled; and there were enough sheets to make the shirt last a year. This yarn was printed in various newspapers and at last in Brazil. "The gullibility of the South American may be appreciated," said Mr. Edison in a recent interview, "when it is known that soon after the shirt story met their eyes the Brazilians began to send me drafts and checks for shirts. One idiotic diamond dealer sent me a draft for £100 on the Bank of England. He wrote that he didn't know how much the shirts were, but he did not think they ought to cost over a hundred pounds apiece."

THERE is on file in the County Clerk's office in this city a record of a judgment against Public Works Commissioner Rollin M. Squire, in favor of the Church Water Waste Indicator Company, of Boston. The history of Squire's dealings with this concern, which is said to have been named after the inventor of the contrivance to be dealt in, the present Chief Engineer of the new aqueduct, Benjamin S. Church, makes a curious little chapter.

A little over one year ago, when Squire was Commissioner of Public Works, he was asked by the officers of the company to go to Boston and use his influence with the Boston city officials, and particularly with the local legislative body there, so that Mr. Church's patent waste water indicator could be introduced in that city. Squire entered heartily into the scheme, more especially as he was promised two-thirds of the profits on all the indicators which he could induce the city to purchase at the price agreed upon.

Between May 15, 1885, and March 11, 1886, he sold 10,000 of these indicators. He made no return of the sales effected, but quietly drew the full amount due by the city, $25,949.72. The president of the company heard what Squire had done, and demanded an accounting. He told the Commissioner that the profit on the sale of the instruments amounted to over $11,000, and that at least $3,666.66 was due to the company. Squire pleaded poverty, said that he had used the money and could not pay it. Maurice B. Flynn, when the matter was brought him, paid various sums on different occasions to square the account for Squire. Recently Flynn ceased to make payments, and so the judgment was entered against Squire.

SQUIRE AND FLYNN are both less than 40 years old. They are handsome men. Both gentlemen part their hair in the middle and both dress like pinks of perfection. Both wear curling moustaches, and both have blue eyes and a fair complexion. There the resemblance ends. Squire is talkative and gushing. FLYNN is reserved, silent and retiring. FLYNN'S father was a poor grave-digger in Columbia county. The son came to New York fifteen years ago, without a cent, and secured a situation in a manufacturing establishment by answering a newspaper advertisement. He was always natty in dress. At this time, although receiving but $10 a week, he dressed in exquisite taste, while living in a room in a rear tenement house in Brooklyn, for which he paid $4 a month. He won a partnership in the firm by his integrity, industry and devotion to the fair sex, and branched out into politics. He secured large municipal contracts for his firm and became a millionaire. He is credited with clearing between $600,000 and $1,000,000 a year by his contracts alone. He married a daughter of Theodore Moss, of Wallack's Theatre, and went to Europe last year, bear-

ng a letter of introduction from President Cleveland to President Grevy, of the French Republic.

Thompson was extravagant in his tastes. He must have drawn heavily upon the pockets of his friends. His bill at the Hoffman House alone for one year was over $37,000. As he was without a cent, and as he had no income, he was undoubtedly a great bill of expense to FLYNN. When Thompson failed to secure the collectorship of the port his friend was much chagrined. Whether he cut down Thompson's supplies or not, certain it is that SQUIRE put his knife into the genial Hubert. Two months ago he began to butcher Thompson's political retainers, substituting therefor sworn henchmen of Tammany Hall. He apparently cared nothing for FLYNN, probably fancying that the publication of his letter would prove more damaging to that gentleman than to himself. What explanation FLYNN made to Thompson is uncertain, possibly he used Squire's action as a ground for decreasing Thompson's money supplies. Certain it is, however, that a coolness sprang up between them. Hubert was suspicious, and took his revenge by leaving Pandora's box open when he died. SQUIRE's letter was in the box from the date of its compilation, and it blew into the hands of Squire's mortal enemy Mayor Grace. What punishment will be inflicted on FLYNN and SQUIRE the future will reveal.—*Amos J. Cumming's Letter.*

SAMUEL J. TILDEN has by will left about $4,000,000 for a free public library in New York City. The famous Astor library original endowment was $400,000.

W. H. CILLEY, and a large staff of engineers, arrived at Panama, July 24th from New York and proceeded to Peru to complete the great Oroya Railroad there and extend it to the renowned silver mines of Cerro de Pasco, for which project Mr. M. P. Grace has received a concession from the Peruvian Government.

THE Aqueduct Commissioners adopted a resolution on Wednesday, requesting the Comptroller to send the monthly amount due the employés on the new aqueduct along the line of the work, so that the engineers and others would not be compelled to come to the city for their pay.

The Committee on Construction recommended that the following be assigned as division engineers in charge of the various divisions of the work along the line: First division, Charles S. Gower; second division, J. W. Wolbrecht; third division, Alfred Craven; fourth division, J. B. McIntyre; fifth division, E. W. Wegmann, Jr.

Robert H. Moore, clerk in Chief Engineer Church's office, handed in his resignation, to take effect on September 1st. Joseph Ryan, Sarsfield Kennedy, Robert De Witt and Cornelius J. Lynch were appointed chainmen, and John F. O'Brien an inspector of masonry.

David Stevenson, C. E.

Mr. David Stevenson, of Edinburgh, the well known civil engineer, died at North Berwick on Saturday, the 17th ult.

Mr. Stevenson was the third son of the late Mr. Robert Stevenson, the engineer of the Bell Rock Lighthouse, and was born at Edinburgh in January 1815. Educated at the High School and University of Edinburgh, he was elected from the first to follow his farther's profession. Before entering on his apprenticeship he was for some time in the workshops of one of the best practical millwright engineers of his day, where he acquired manipulative skill and the proper methods of working in different materials—a course he always advocated for those who intended to follow the profession of civil engineering. After serving a regular pupilage as a civil engineer, he was for some time engaged with Mr. Mackenzie, contractor on the Liverpool and Manchester Railway. He then returned to Edinburgh, and in conjunction with his father and his brother Alan, began practice as an engineer.

Along with his brother, his advice was much sought in regard to the improvement of rivers and harbor and dock works. He was the first to enunciate the true theory of the origin of bars at the mouth of rivers, and also to define the different compartments of rivers and estuaries, and the proper treatment which each should receive for their improvement. His book on "Canal and River Engineering," giving the results of his experience in the treatment of rivers, will long remain the standard work on the difficult subject of which it treats. In 1853, Mr. Stevenson succeeded his brother Alan as engineer to the Northern Lighthouse Board, and along with his brother Thomas he designed and executed no fewer than thirty lighthouses, two of which—on Dhuheartach and the Chicken Rock—are triumphs of engineering. In addition to the Scottish lighthouses, the advice of the deceased's firm was taken by the Governments of India, New Zealand, Japan, and Newfoundland on lighthouse matters, and under their direction schemes for the lighting of the whole coast of Japan and New Zealand were matured, and are now being carried out. In connection with the lighting of the coast of Japan, where earthquakes are frequent, Mr. Stevenson devised the aseismatic arrangement to mitigate the effects of earthquake shocks on the somewhat delicate optical apparatus used in lighthouses.

Mr. Stevenson frequently appeared before parliamentary Committees, and also gave evidence before several Special Committees and Royal Commissions on Harbors of Refuge, River Improvements, and Lighthouses. It may also be mentioned that his firm designed and carried out the Edinburgh and Leith sewerage scheme, and the widening of the North Bridge.

Mr. Stevenson found time amid the exacting calls of his profession, to write several books which have taken a permanent place in engineering literature, such as "The Application of Marine Surveying and Hydrometry to the Practice of Civil Engineering," "Reclamation and Protection of Agricultural Land," "The Principles and Practice of Canal and River Engineering." He also wrote several articles for the last and present edition of the "Encyclopædia Britannica," among which may be noted "Canal," Cofferdam," "Diving," and "Dredging." He was also the author of "Our Lighthouses," being two articles written for his old friend Dr. Norman Macleod, while editor of *Good Words*, and subsequently published by Messrs. Black; and of the "Life of Robert Stevenson." published in 1878. Mr. Stevenson was elected a Fellow of the Royal Society in 1844, and he subsequently acted as a member of council and one of its vice-presidents. He was a member of the council of the Institution of Civil Engineers, and a member of the Society of Civil Engineers, Paris, and of other learned societies. He was consulting engineer to the Highland and Agricultural Society, and to the Convention of Royal Burghs. —*The Scotsman.*

CORRESPONDENCE.

Concrete in Dakota.

IOWA, Aug. 4th, 1886.

EDITOR ENGINEERING NEWS:

To what extent is it safe to use concrete in the erection of house and barn in Dakota? How ought it to be mixed? Gravel, sand, and wind plenty, lumber scarce.

B.

Machines for Laying Water Pipe.

CHAMPAIGN, ILL. Aug. 2, 1886.

EDITOR OF ENGINEERING NEWS:—

For some time I have been intending to inquire through your columns if any one knew whether machines similar to those used in the West for opening trenches for tile drains had ever been used in laying water and gas pipes. If think I have seen some reference to that effect, but can not recall the particulars. If any of the readers of the NEWS can give a few items in that connection it will be gratefully received as a matter of general information. In the trial of tile ditching machines, held here recently, all the machines, worked excellently, and I could see no reason why they could not be employed as above.

I. O. BAKER.

Commissioner Squire and his Claim to Reform in the Department of Public Works.

NEW YORK, August 9, 1886.

EDITOR ENGINEERING NEWS:

Commissioner Rollin M. Squire lays great stress on the "reform methods," lately inaugurated by him in the Department of Public Works, wherein he shows, that by his retrenchments and dispensing with needless employés, he has already saved the city something like $65,000 yearly in salaries—allowing it to be thence inferred, that his predecessor had packed the department with dead-heads, presumably political followers-whom, but for his sense of what was due the already over-burdened tax payers, would have continued for an indefinite time in the future to draw from the City Treasury this large amount of money, for which no services are rendered.

The public will not probably be surprised to learn that this "reform" to which he alludes as due his individual exertions, has no foundation whatever in fact.

In the Act of the Legislature creating the New Aqueduct Commision, Section 6, it is made the duty of the Department of Public Works of the city to prosecute all surveys of location for said aqueduct, surveys of lands for all purposes, shafts, reservoirs, claims and appurtenances of all kinds, and prepare all plans, which, submitted to the Commissioners after discussion by them, are modified more or less, sent back to the Engineer Bureau Department of Public Works, to introduce the modifications, new plans furnished, again changed, until finally brought to suit the advanced views of these experts in hydraulic science, they are sent back for six complete copies to be made for the final endorsement of the Aqueduct Commissioners, prior to their being placed on file as complete.

The amount of work to be done was enormous; nothing approaching it was ever seen on a public work in this country, or elsewhere, and to carry on this work under the Engineer Bureau of the Department of Public Works a large force of subordinates was necessary, who have been actively engaged under the Chief Engineer, Croton Aqueduct, and are still so engaged, and paid upon pay rolls prepared by him, and from the Croton Aqueduct fund, and not from the fund provided for the new aqueduct; all the preliminary examinations, borings, etc., and expenses incidental thereto, have been paid from the Croton fund, and the Chief Engineer of the Croton Aqueduct has had to certify to the accuracy of these pay rolls, and for some time past has been endeavoring to close up this account, as the plans were approaching maturity, and has been urging that the New Aqueduct Commissioners will no longer delay the necessary discussions and modifications prior to adopting the plans already prepared, that his responsibility in the matter may cease as soon as possible and the expenditure for salaries reduced. Some plans still linger before the Commission and it is scarcely a secret that the election of a Mayor this fall will be made a factor in this matter of delaying action, though why politics should influence the question of say, the construction of the Quaker Bridge Dam, is hard to perceive by the ordinary mind, but so it is. The majority of this work being completed, the Chief Engineer of the Croton Aqueduct, made such representations to Commissioner of Public Works Squire in reference to these temporary employés of the Engineer Bureau, as led to their names being dropped from the pay rolls. This action on part of the Chief Engineer, was seized upon by Mr. Squire as a measure of "reform," emanating from himself, and due publicity being given to it, as a saving effected in the "management of his department to the extent of $70,000 annually!" It is true, that in making this reduction of the force, Commissioner Squire could remove whom he pleased, and thus retain those who owed their situation to such political influence as he was disposed to recognize, and it is rumored, that if he had made a different selection in his dismissals, his own official life might have been extended—the damaging letter of his, believed by him to have been destroyed, having been for months in the pocket of H. O. Thompson, whose friends were the chosen victims of the Commissioners newly formed zeal for "reform."

AN OBSERVER.

Rack Railroads.

PARIS, July 23, 1886.

EDITOR ENGINEERING NEWS:

As Secretary of the French Society of Civil Engineers I am reading regularly your excellent journal.

In your number of May 22nd, in reference to the Abt system of railway, I have observed with regret the following passage:

"Riggenbach rack-rail. Erroneously so called. It is substantially the rack-rail, which was first introduced by S. Marsh, on his Mount Washington railway Riggenbach, who was acquainted with Marsh's rail, modified it somewhat without altering its principle."

There exists here a manifest error. I do not contest that the Mount Washington Railroad was built a short time before that of the Rigi. But the rack-rail of Rig

genbach was patented in France *since August*, 1863, and that engineer therefore ought not to be accused of having copied since 1863 the rack-rail of Marsh, which did not appear until five years afterwards. The patent, which is on file in the Conservatoire des Arts et Metiers, in Paris, establishes this fact absolutely. It has also been recently republished in "Glasers' Annalen für Gewerbe und Bauwesen." Trusting in your good faith and your responsibility, I therefore would ask for a rectification in that respect.

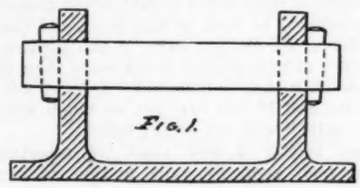
I have to add that it is singular that everywhere where the Abt system is spoken about, this same inexact mention of the Riggenbach rack-rail recurs. I can not suppose that these representations emanate from Mr. Abt, who, being formerly in Mr. Riggenbach's employ, must know the truth better than any one else. If it were otherwise, such a manner of acting against his former chief, without adding anything in reference to his manifest value as an engineer, would make little honor to his character.

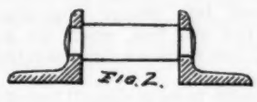
Should the feelings of good fellowship not suffice, then I may refer to my capacity as Mr. Riggenbach's representative in Paris to ask from you this rectification.

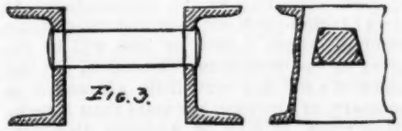
Please, sir, to believe in the expression of my most distinguished estimation. A. MALLET,

128 Boulevard de Clichy.

[It appears that in 1863 Mr. Riggenbach had secured a French patent for a rack-rail. In 1868, five years afterwards, he published a pamphlet in which he advocated the application of the rack for the then projected St. Gothard railway. His rack-rail, as illustrated and described on that occasion, consisted substantially of a kind of channel bar (Fig. 1) into the two parallel walls of which the cogs were introduced *by pressure*, and each was secured at its ends *by keys*.







In 1867 Mr. Sylvester Marsh commenced to build his Mount Washington railway. He made use there of a rack (Fig. 2) constructed of two angle irons with *the teeth being shouldered* and *riveted* in between.

The application of a rack to overcome steep railway grades, was patented already in England as far back as 1811: the device therefore is a very old one, and the merits of subsequent designs can only rest in modifications of detail, and modes or facilities of manufacture. It is herein where we have the characteristic difference between the above two forms. Mr. Marsh's rail is comparatively easy of make, due regard being taken in every respect to the practical possibilities of tools and labor, while Mr. Riggenbach's shape is the very opposite, bordering closely to the practically impossible, and we venture to say that neither the Rigi nor any other kindred road would ever to this day have been built with his rail.

In 1869 Mr. O. Grüninger, C. E., now of New York, at Mr. Riggenbach's request, examined the Mount Washington Railway, and forwarded in June of that year a careful report, embracing every detail of construction. Thus it happens that in 1870 in the rack-rail of the first Rigi railway (Fig. 3) and since then invariably, we find Mr. Riggenbach adhering to the essential features of Mr. Marsh's Mount Washington rail, *i. e., shouldered teeth* and *riveting*.

The accompanying cuts show also the relative sizes of the rack-rails as proposed or as built.

As a matter of fact the Rigi railroad in most of its important details, is closely copied from the pre-existing American line. To mention but one of these details we refer to the method of going down hill by using the cylinders as air-compressors. Air is drawn into the cylinders—but not through the smoke-stack. It is then compressed, but instead of being forced into the boiler, communication with the latter is completely shut off, and by regulating, through a stop-valve, the escape of the compressed air into the atmosphere, the downward motion of the train, from a dead stop to any desirable speed, is under absolute control.

We desire to state emphatically that we have held no communication directly or indirectly, with Mr. Abt concerning the subject of his rack-rail.—ED. ENG. NEWS.]

Complimentary.

GLENVILLE, W. VA., August 5, 1886.

EDITOR ENGINEERING NEWS:

I received your circular announcing the proposed publications on Surveying, in its different grades. I am glad that you are giving that subject more attention, as it is interesting to a *few* of your subscribers, although I take it that the majority of them are very little interested in that class of work. I understand, that you can not publish matter to suit *all* readers, and consequently usually publish what best suits a majority of them. But to your credit I will say that there is very seldom a number of the NEWS appears that does not contain something of interest to *every* engineer, surveyor and contractor that reads it.

Very respectfully,

ROBERT L. RUDDELL,
Surveyor.

A French Engineering School.

L' ECOLE DES PONTS ET CHAUSSEES.

Translated for Engineering News.

Senator Lalanne, of the French Institute, has written an interesting account of the above school in the *Magasin Pittoresque*, from which we translate the following:

In 1744, Trudaine, the Minister of Finance, proposed that a general survey and mapping of the highways of France, should be made. In 1747, the celebrated Perronet, who may be called the Vauban of this engineering corps, was appointed director of the draughting bureau, and somewhere between 1755 and 1760, the designation of Ecole des Ponts et Chaussées was adopted, but was only officially applied for the first time in an order by Turgot, February 19, 1775. The body of civil engineers known as Corps des Ponts et Chaussées was first organized by a royal decree, February 16, 1716.

The National Assembly passed a law, January 19, 1791, instituting a national and free school, and it was specified that the professors should be selected from the most capable pupils. Sixty pupils were to be admitted after passing an examination in the various departments of France, before special juries.

It is very characteristic that even in these troublesome times the civil engineers of France had everywhere conciliated public opinion and attained a distinguished position in State administration. It was only a few months afterwards, when this same National Assembly passed a special law, (August 18, 1791), giving Perronet a salary of 22,600 livres ($4,520, but now equivalent to, perhaps, three times that amount) *per* annum, "in consideration of fifty-four years labor in various branches, etc."

Various changes were subsequently made in the organization of the school and the corps, the most important being that of October 22, 1795, by which the school was retained as an *école d'application* of the *Ecole centrale des travaux publics*, which institution became later on the well-known *Ecole Polytechnique*. These *écoles d'application* included those of military engineering and artillery, naval engineering, powders and saltpetres (!) geographical, hydrographical and mining engineers, etc. All these had to be recruited from the *Ecole Polytechnique*. From that time until very recently no engineer was admitted into the Corps des Ponts et Chaussées without having first passed through the school of the same appellation.

The corps and the school were somewhat modified by laws passed in 1804 and in 1851. It is very curious that these words (*ponts et chaussées*)—bridges and highways—are still an official designation and a sacramental phrase, although they have so little relation with the importance and true nature of the works comprised under such a phrase. Even de Tocqueville, the celebrated writer of "Democracy in America," makes allusion to this fact in his work L'Ancien Régime *et la Revolution*. "The institutions of the old régime, more of which than is commonly supposed were carried over into the new society, generally lost their names during the passage, even when keeping their forms, but this (the *Ecole*) maintained both—a rare fact."

The number of students was reduced to thirty-six by a law of the 30th *Vendémiaire*, but the number was soon raised and the average annual number of students passed from the school to the corps from the beginning of this century has not been less than twenty. In 1851, day, or outside, pupils were first admitted, and foreigners were given all the privileges. During the preceeding twenty-five years, "auditors" had been admitted to the number of 187, of which 148 were foreigners. Among these latter were: Poles, thirty-eight; Americans, twenty-eight. Among the most celebrated of these foreigners were: the Hungarian General Bem (1839); the celebrated Charles Ellet (1830), who was mortally wounded on the Mississippi, near Memphis, June 6, 1863, while on board of a fleet of rams with which he and his brother sunk or captured seven of the Confederate fleet.

Among the foreign nationalities attending the school, the Poles came first, and next, Roumanians, Americans, Portuguese, Austrians, Italians and Grecians. One Chinaman, who died in 1883, displayed some very creditable qualities and capacities. Since 1875 *preparatory* courses have been given which are of great advantage to foreigners, and which give them that familiarity with the language which is so essential. This liberality towards foreigners has greatly contributed to make friends for French engineers all over the world, and to form that kind of good fellowship and "free masonry of professions," which ought to exist among such a body of men.

There is in France a special body known as *Conducteurs*, and which has an equivalent in England in the "Clerks of the Works"—these were admitted as day pupils in 1869, and their pay continued. They must serve ten years before being admitted to pass an examination as engineers.

The programme of studies is very complete, and will not be without interest as showing the encyclopediæ requirements of modern civil and military engineering. The course of studies includes: all kinds of roads and their working—highways, railways, canals, rivers and harbors; bridges and viaducts, locks, subterranean ways, lighthouses, public buildings, with the requisite knowledge of applied mechanics, hydraulics and machinery—especially those with steam power—and also of building materials, geology, mineralogy, chemical analysis, etc. In addition to these branches, lectures are given on administrative law, electric telegraphy, photography, pisciculture, etc. Any great engineering scheme or new invention is at once treated of—such was the case for the Suez canal, the Alpine tunnels, the telephone, phonograph, etc. One foreign language—English, German or Italian, must also be acquired, and a good French style and a knowledge of landscape drawing complete the course. An extensive library, instruments and models of all kinds, and a laboratory, are in the building. The pupils, too, are taken to see public works in course of construction

and brought in contact with the men and the things they require to know.

The school has undergone many changes of location—first situated in Rue de la Perle, it was removed to various quarters, and finally to 28 Rue des Saints-Peres, where large additional buildings are to be made.

The edifice was first built as a private residence by a "*fermier général*" about the middle of the last century, the principal stairway and vestibule are very fine, and in them are busts of the most celebrated pupils of the school—among them we may mention: the fine bust of Perronet, (in the hall of the London Royal Society, the bust of Perronet is alongside that of Franklin;) Victor Legrand, Cessart, who distinguished himself at the battle of Fontenoy, and did much in harbor works, especially at Cherbourg; Brémontier, who first found the method of fixing the movable sand of dunes; Navier, the discoverer of the laws governing the stability of construction of various kinds; Poirée the inventor of movable dams; Vicat who saved millions to every country by his discovery of the conditions affecting the setting of calcareous cements and mortars under water; Fresnel, the collaborator of Arago, who first showed the true theory of the propogation of luminous waves, and his application of it to the illumination of light-houses.

The school, however, had other illustrious pupils whose busts do not appear—among them: Gay-Lassac, the eminent natural philosopher and chemist, Cauchy the mathematician, Montalivet, etc. Perronet was at the head of the school during forty-five, and Prony forty-one years.

A beautiful granite obelisk in the yard bears the names of two engineers killed during the war of 1870-71; Holl who died of his wounds, and Choulette, killed at Belfort.

Maintenance of Way on East Indian R. R.

BY T. W. JONES, OF THE EAST INDIAN R. R., CALCUTTA.

TURNING AND CHANGING RAILS.

In a curve, rails, in addition to being turned in their beds, should be turned end for end. Most permanent waymen know this, but many do not carry it out, and the result is that many curves appear to have straight places in them.

Before turning a rail, see what room there is for expansion after the fish-plates are taken off. If the day is warm and the joints on both sides jammed, it will be advisable to postpone the work until the weather is cooler, or a short rail can be put in. When putting in a new rail, measure it carefully and satisfy yourself that it will suit before the old rail is taken out. There is often from one-quarter to half-an-inch difference in rails supposed to be of the same length.

Trains have often been detained three or four hours for want of the above precautions; either the rails on each side have expanded while the bad rail was being turned, or the new rail has been too long. In either case, the work could not be completed before trains were due.

Always see that the top of the new or turned rail is exactly level with the top of the rails on either side; if it is not, use small liners (or packing pieces) of hoop-iron on each side between the top of the fish-plate and the upper flange of the rails which have not been turned, as it is quite possible that they have worn down nearly one-quarter of an inch, and the liners, will, if properly used, raise them and make a level joint. The liners should be 2" × 1" × $\frac{1}{16}$" to $\frac{1}{4}$" thick, and should be placed 1 inch from the end of the rails. As the bolts are tightened, tap the plates and rails gently with a key hammer until everything fits neatly. Many inspectors call this an old woman's dodge, but it pays. The rails will certainly wear longer where the joints are even than they will where there is from one-eighth to one-quarter of an inch drop at each end of the new or turned rail, causing every wheel to bump or hammer the joints, instead of passing smoothly. With iron rails especially, if liners are not used, hundreds of rails will be damaged yearly, for it may be fairly reckoned that two out of every three turned rails will have the ends more or less battered out.

When changing or turning rails, if any are found *cracked* or in any way seriously damaged, renew them at once, and at the same time put a mark which cannot be easily overlooked or mistaken on each rail. If some precaution is not taken, it is probable that the rails, after being returned to store, will be reissued for making beams or girders, and as rails for such work are seldom tested before being used, a serious accident may be the result.

On some sections cracked rails are broken with a Jim Crow directly they are found, and I think the plan is a good one.

Rails that are *chair-marked* should not be allowed to remain in the main line, as they are very unpleasant to run over. If the ballast is good, and the keys kept tight, rails are seldom, if ever, indented by the chair.

When rails have to be bent with a Jim Crow, as in setting stock or check-rails, or straightening a bent rail, they should always be heated first, or they are liable to crack, especially steel rails. Steel switch-rails are often bent, and they should be made nearly, or quite red hot before the Jim Crow is applied. If there is time to allow them to cool gradually the heating does little injury. (If possible to cool it with oil, it increases the toughness). Rails should never have holes punched in them, but always be neatly drilled. This applies especially to steel rails. From experiments in America, we find that the comparative strength of a

Steel Rail—solid	12.76	tons (foot tons)
" " drilled	1.97	" " "
" " punched	0.195	" " "

the drilled rail thus offering ten times, and the solid rail sixty-five times, the resistance of the punched rail. Hamilton says:

"The ultimate deflection of a punched steel rail is the same as of a cast-iron one of similar section, the weight required to produce these deflections being in the ratio of 2½ to 1, the amount of deflection being so small (less than $\frac{3}{4}$ inches) that imperfect packing of the sleepers might easily permit it; so, if the weight on a driving-wheel were some 60 per cent. greater than it is at present, fracture frequently would occur, and a punched steel rail will be strained beyond the limits of elasticity by the passage of an ordinary train if an intermediate sleeper sank $\frac{1}{16}$ of an inch.

The above shows plainly that steel rails should *never be punched*, and as few holes drilled as possible.

The superior durability of steel rails, and the low price at which they are now obtainable, is causing them to be generally introduced, both on new and old railways; and as it has been proved by actual results in America that one steel rail will last as long as twenty iron rails, the cost of maintaining permanent way should be less in the future than it has heretofore been. There is, however, one point which should not be overlooked. Every year the weight on each wheel of locomotives and wagons is increased, and the speed of trains is also greater that it was ten years ago. Still, the tendency appears to be to make the new steel rails of *lighter* section than the old iron rail.

This is no doubt done on the score of economy; and steel being so much stronger than iron, there is, perhaps, no danger of the rails actually breaking. But will such rails make as steady a road and be as easy to maintain as the old (82 pounds to the yard) iron rails? I think not. Besides, reducing the weight of rails means *increasing* the number of sleepers, so that it is not clear that the saving of 10 or 12 pounds per yard will be of much benefit in the end; and the lighter the rail, the easier it will buckle.

Pieces of scrap rail 3 feet 6 inches to 4 feet 9 inches long are very useful for protecting rail tie rods. Place the piece of rail under the rod and pack it up with gravel or small ballast, so that there is only ½ inch clear between the rail and rod. This will effectually prevent coupling-chains catching the rod.

EXPANSION.

Although this is one of the most important points in permanent-way work, little attention was paid to it in India until a few years ago; now it is frequently overdone, and the rail ends are damaged by being left too far apart. It is impossible to lay down a hard-and-fast rule as to the amount of clearance necessary; everything depends on the temperature and the length of rails, but it should never exceed one-quarter of an inch at any joint, and this is sufficient for 30 feet rails if the greatest difference in temperature is not more than 70 degrees; $\frac{3}{16}$ inch is sufficient for 23-feet rails, as a rule, and if you can get so much with 20-feet rails it will not do any harm.

When laying a new road, or relaying an old one, keep the rails in line as you go; if an angle is left at joint, or a curve where it should be straight, and it is afterwards forced into proper alignment with crowbars, you will find, when the work is completed, less room for expansion than you expected.

It is advisable to have a small box of liners, or expansion pieces, of different thickness, to be used according to the temperature. If liners ¼ inches thick are used first thing in the morning, others ¼ inch or less will be required as the temperature increases. In the middle of a hot day very little allowance is necessary, at any rate, not more than $\frac{1}{16}$ inch.

Iron rings, 1¼ inch or 2 inches diameter, are best for expansion pieces, as they are easily removed with a small hand bar, even when jammed between the two rails. If rings are not to be had, pieces of hoop iron, 4-inches long, and bent in the middle at right angles (so that they cannot fall through) are next best, but be careful that every liner is removed before trains commence running. They should be left between the rails until the keys and fish-bolts for at least 100 yards ahead have been secured, or the moving of the rails in front will probably jam some of the joints.

New rails are slightly elongated by trains running over them, and even on a single line it is generally necessary to give fresh room for expansion seven or eight years after it is opened for traffic. On a double line the rails always travel in the same direction as the traffic, and this is a continual source of trouble, for the up-line joints will be jammed from the crossings, at the up entrance to the station, to a mile or more back, and the down-line joints will be jammed on the other or down entrance. On the other hand, both lines will, as a rule, have too much expansion for the first two or three miles after leaving the station, and to remedy this, the rails have to be pulled back continually. The right hand rail always travels more than the left hand rail, and it is not always worth while trying to keep the joints exactly square, for if the end

of the right hand rail is 2 inches or 3 inches behind the left hand rail, it will soon right itself.

There are many different opinions as to why rails travel. Most writers on the subject assert that they always travel down hill. This does happen on a single line if the grade is sharp, but it certainly is not the case on a double line. It may be taken as a fact that the rails *which deflect* most under the train *travel quickest*, and I will endeavor to explain why they do so. As the engine advances, the rails which it is traveling are depressed, say, ¼ inch rails, but the rails in front retain their original level until the wheels reach them. The engine is, therefore, to a certain extent, always traveling up-hill, and as it moves forward, the rails are pushed in the same direction. The greater the deflection the more resistance there is to the wheels, and, as a matter of course, the more pressure forward on the rails. In fact, if an instantaneous photograph of the permanent-way were taken while a train was passing over it, the rails would look like a number of small waves, and the wheels drive the rails ahead something after the manner in which water is forced onward by the bow of the vessel.

It may be argued that if the above theory is correct, rails could be prevented from traveling by making the line sufficiently rigid; but if the rails were so fixed that they could not deflect at all, the road would be very hard and unpleasant to run over, and the damage to the rolling stock and permanent way much greater than at present.

Several contrivances for preventing the traveling of rails on double road have been tried, but up to the present none have been effectual. It is, however, pretty generaly acknowledged that where the Denham and Olphert's sleeper is laid continuously for long distances, the creeping or traveling of rails is almost *nil*.

Some Inspectors calculate the traveling of the outer (or left-hand rail) at 2 inches a year, and of the other, or right-hand rail, at 6 inches a year; others put the former at 4 inches and the latter at 9 inches every year; but I do not think any absolute rule can be laid down; so much depends upon the rails, gradients, speed of trains, and the condition of the road.

If any portion of a section requires room for expansion, and it is impossible to put the work in hand before the hot weather, have a few rails cut and kept ready close to the spot, so that, if the road does buckle, it can soon be put right. In cutting rails, it is important to have it done neatly and to save drilling holes so much as possible; for instance, if the first bolt hole is 3 inches and the second 7 inches from the end of rail, by cutting off 4 inches only, one hole will have to be drilled instead of two.

If too much room for expansion is left, the fish-bolts, and sometimes the plates, will break in the cold weather, especially at night, and there will be trouble in changing or turning rails during the mornings and evenings, as the bolts will be jammed; and although they may be driven out with a steel punch, the probabilities are that the rails on either side will contract so much that it will be hours before the bolts can be put in again.

SQUARING JOINTS.

If, on a straight line, the joints are 8 inches out of square and the rails are 20 feet long, put in a 19 feet 8 inches rail on each side, and pull the rails on one side from east to west, and the other side from west to east. This will enable you to give the same quantity of expansion, on each side, and the sleepers will have to be moved less than if a 19 feet 4 inches rail were put in on one side and no cut rail on the other. If all the joints need expansion, move one rail at a time, take out the bolts on one side of the joint, and loosen the others; take out the keys, if wood; if Denham and Olphert's sleepers, only loosen the cotters, and the rail can then be easily moved with a small hand bar, and the proper amount of expansion-room given at each joint. Keep a chisel or a liner between the ends of the rails until the rails ahead have been moved and the keys driven home. This will prevent the rails moving back.

In a curve of, say, a mile radius, if you use a 19 feet 8 inches on the outer side, a 19 feet 6 inches will be required on the inner sides Sharper curves will require a greater difference between tho outer and inner rail. When laying a curve of 4,000 or 5,000 feet radius with new rails of 20 feet, it will be necessary to use one 19 feet, 8 inches on the inner side of the curve to every 20 full length rails, to prevent the inner rail getting ahead of the outer rail. When you find the inner rail is 2 inches *ahead*, put in a 19 feet 8 inch-rail; this will leave the inner rail 2 inches *behind*; and, by working this way, you need never have the joints more than 2 inches out of square.

On a double line, it is impossible to keep joints square for any length of time (see the chapter on expansion), and if expansion is required, the joints should be squared at the same time, and so save time and trouble. If two days in each week are devoted to this work, a great deal can be done in a year.

Before commencing to square joints give room for expansion or pull back rails; have all the fish-bolts oiled, unscrewed, and screwed up again; also see that the joint sleepers are far enough from the joint to allow the rail, with fish-plate attached, to be moved as far as is necessary; if they are too close, have them moved beforehand, and it will then be easy to pull back, or move in any way, half a mile of rails (one at a time) whenever there is one hour clear between trains. If you are waiting for a train to pass before commencing work, the time need not be wasted; one bolt may be taken out, and another slacked at each joint, without making the road unsafe, and it will be so much less to do after the train passes. In the same way it is not necessary to detain trains until all the bolts are secured; if one on each side of the joint is screwed up it is quite sufficient for safety. It is, however, advisable to have all the bolts put in before leaving the spot, for although a joint is quite secure with two bolts, one of the two may chance to break, and if the other were to follow suit, the joint would be left without any fastening and probably cause an accident.

LIFTING ROAD, PACKING SLEEPERS, ETC.

Never allow road to be lifted by the eye alone if it can be avoided. No matter how experienced a man may be, his eye can never be considered an efficient subsitute for a spirit-level and straight-edge.

The joints should always be lifted first and then the intermediate sleepers. Always lift by the rail; for, if the lever or crow-bar is placed under the sleeper, it will throw the road more out of line than if it were placed under the rail, besides the risk of breaking the chair.

Unless the mistry is a very good hand (and the best should be tested occasionally,) have the lifting commenced when you are present, and it will then be easy to explain exactly what has to be done. If the spirit-level, straight-edge, or sights are out of order *ever so little*, or the straight-edge is not properly levelled to begin with, the work cannot be done properly.

Always lift both rails at once; in a curve the proper amount of super-elevation should be given at the same time; if the lift is a heavy one, and the gang small, it will be safer to make two lifts of 3 inches than one of 6 inches; the work may take longer, but there will be less danger of detentions and reports.

On a double line, lift towards the approaching train, *i. e.*, if the line runs from east to west, lift from west to east on the up-line and from east to west on the down-line. A change of level is always felt less when the engine has to rise than if it were to drop an equal distance. This also applies to steep gradients on a single line. If the lifting is commenced at the bottom of the bank and worked upwards, it will suit down trains, which are sure to run fast down-hill, and as the up-hill trains will be running slow, the lifting will not interfere so much with them. When lifting 3 inches, or above, advise the nearest station-master in writing, giving mileage and time at which the work will be done, and have hand-signals at a proper distance from the work as per rule book. If a train approaches, slope, or run out, the lift 1 inch to every 25 feet (*i. e.*, if the lift is 4 inches, the slope should be 100 feet long,) but when leaving off work at night, the length and slope should be double, or 200 feet at least for a 4 inch lift.

Never allow an engine or train to pass until everything is safe. It is easier to explain ten or fifteen minutes' detention than a serious accident. Some Engineers and Inspectors object to caution-signals being shown to mail or passenger trains. Their intention is, no doubt, that work which would necessitate the use of caution-signals should not be taken in hand when such trains are due, and this is to a certain extent correct; but to forbid a mistry or any one to show danger or caution-signals to any train is very unwise, and will probably cause an accident. Trains often appear sooner than they are expected, or a piece of work takes longer to complete than was anticipated, and it is certainly better to stop even a Viceregal train, than to run any serious risk.

If possible, straighten the road after lifting before allowing trains to pass; in any case, this is a point which should always be attended to before leaving the work at night. When lifting a straight road, it is not advisable to leave both rails exactly the same level, for the outer rail (the one nearest the slope) will sink much more than the other. If, on a good embankment, the outer rail is lifted ¼ inch higher than the inner rail; at the end of six months both rails will be found level. On a sandy or black loam bank ½ inch difference of level may be allowed; but whatever it may be, it is important that it should be the same throughout, for it is an undoubted fact that the wheels always follow the highest rail, and if the outer-rail is half an inch higher than the inner-rail for 400 or 500 yards, and and half an inch lower for the next 400 or 500 yards, vehicles of all descriptions will oscillate much more than they would if one rail were highest throughout. Some may disagree with me, but it has been proved both here and in America that trains always run steadier on a piece of road where one rail is higher than the other (within a reasonable limit, of course) than they do on a piece of road where both rails are the same level.

Many men have no fixed rule as to how sleepers should be packed and those who have a rule are not always careful to enforce it; the result is that in some places the sleepers are only packed 9 inches or 10 inches on each side of rail (or say 3 feet 6 inches out of the 10 feet); in others, 15 inches or 18 inches on each side of rail, and some few pack the whole 10 feet but not so hard in the center as at the ends. I have tried every distance in turn, and have come to the conclusion that 1 foot

inches on each side of rail is the proper distance for the 5 feet 6 inch gauge. Including the width of rail-heads, this gives 7 feet 5 inches for a 10 feet sleeper, and leaves 2 feet in the center, which *should not be touched* with a rail-beater, the ballast being simply filled in loosely with a rake. Some men contend that 1 foot 3 inches on each side of rail is ample, but they should remember that engines and trains are heavier and run faster than they did ten years ago, and the English standard gauge is 9½ inches narrower than the Indian broad-gauge. For the metre-gauge, pack 1 foot 2 inches on each side of rail.

The joint sleepers should always be packed last; for with good ballast, it is easy to lift the road by backing hard, and if the intermediate sleeper are packed after the joint sleepers, it will, to a certain extent, take the weight off the latter, and they will not be so firm as they should be. The following plan answers well: After lifting and packing all the sleepers, divide the gang into lots of four men each, and let them go over the road a second time, packing the joint sleepers *only*.

The ballast should always be opened out on both sides, and the sleeper packed at both ends at the same time. This is the only way to secure a solid bed, even when picking up slacks or low joints; if a sleeper or rail is low on one side only, it is necessary to open out and pack *both* sides (although only one side need be lifted), for by packing at one end you disturb the other, and if you do not pack it afresh it will soon be loose and give trouble. A good many sleepers are damaged on account of the ballast not being opened out to a sufficient depth, and the rail-beater head, instead of going right under the sleepers, only smashes the edges.

Never box-up road immediately after lifting (except in a station yard or a level crossing); if possible, leave it for a day or two (or even longer), and then go over it again picking, up slacks, &c., and when boxing, pack all the joint sleepers again no matter how firm they may appear; the road should then stand for a long time.

Never have a joint on a small girder-bridge or inside the check-rails of a level-crossing if it can be avoided; for, in the first case, you throw more strain on the girders than is necessary, and, in the second, it is difficult to lighten or change the bolts; and as joints always sink sooner than any parts, there is always extra trouble in opening out the ballast to admit of the sleepers being packed afresh.

If not checked, permanent-way coolies will pick out the largest piece of stone procurable, and hammer away at it with their rail-beater, wasting time and damaging the sleeper (for it is often impossible to force the stone under it). Stone above 2½ inches diameter will never pack properly under sleepers, neither will dirt or rotten stone make a reliable road. Thousands of sleepers are spoilt yearly for want of good ballast, and even when new ballast is supplied, it is often used injudiciously. On many sections the dirt and bad ballast is cleared out level with the bottom of sleepers, and new ballast put in and fully boxed without any lifting being done. Painting the road in this way improves the general appearence, and keeps the sleepers drier, but does not make a better running-road, as the sleepers are still on the old dirt bed. After clearing out the dirt, the road should always be lifted on to at least 4 inches of new ballast. This will do more good than putting a foot of good stone on top of the sleepers.

If, from any cause, such as an over-bridge, tunnel, etc., it is impossible to lift the road, a new bed of good ballast may be put in as follows: First clear out the old ballast, or dirt, between the sleepers down to 4 inches below bottom of sleeper, and fill the trench up with new ballast; then move every second sleeper on to the new-ballast, and clear out the dirt, &c., from the old bed; after this has been filled with fresh ballast, the sleepers may be moved back to their proper positions and the remaining sleepers moved. This is very slow and expensive work, and should never be done if it is possible to lift the line.

The remarks as to outer-rail sinking sooner than the inner-rail is, of course, only applicable to a double line, or a single line laid on a double bank. where the bank is only wide enough for a single line, both rails are, of course, the same distance from edge of slope and should sink equally.

High Bridge Building.

Farmville, Va., Journal.

There is some very interesting and important engineering work now in progress at the celebrated High Bridge of the Norfolk & Western Railroad some five miles from Farmville. When this bridge was built many years before the war, it was considered a great achievement, and even in these later days it is still to be reckoned among the larger structures on the continent, being 2,352 feet long in twenty-one spans of 112 feet each, while it is 90 feet high at each end and 120 feet high over the Appomattox river, the piers of brick resting on granite basis, and both brick and stone are yet in good condition showing clearly defined sharp edges and hard mortar.

The original superstructure was a wooden "Burr Truss" with arches footing into the bottom chords, which in turn rested on wooden bolsters on the brick work of the piers, which were not covered with coping stones; and the track was carried on cross beams resting on the top chords. During the military operations of 1865, the four spans at the west end of the bridge were burned, and were shortly replaced by trestle work, in which great care was exercised to provide against the end thrust of the arches in the remainder of the bridge, as the old bottom chords were permeated by decay, and the arches were doing all the work by abutting against each other on the pier tops, yet in this condition of unstable equilibrium the structure successfully carried the light weight engines and trains of the old South Side Railroad Company, until that company was merged with the Norfolk & Petersburg and the Virginia & Tennessee, into the Atlantic, Mississippi & Ohio under the presidency of General Mahone and the general management of Major Henry Fink.

Early in 1870 a contract was made by Smith, Latrobe & Co. (Baltimore Bridge Co.) to remove the wooden structure and replace it with a new "Fink Truss" in wrought-iron, resting on iron towers to be placed on the piers, and to uncover the piers and afford other facilities through which the railroad company should put heavy granite coping stones on top of the brick work. These operations and the condition of the old wooden bridge made it necessary to take the traffic off the bridge and a temporary track with heavy grades was built around the bridge and over the river on trestle work. Within three and a half months from the taking off of the traffic, the new bridge was ready for it to be put back again, but some delays in regrading the approaches made it four months before the trains crossed the new bridge. The iron for this bridge was manufactured by the Phœnix Iron Company of Philadelphia, after the designs of Charles H. Latrobe, and was erected by Charles W. Bayley under the general direction of Fred. H. Smith. There were nearly five spans of falsework timbers used and the working forces averaged about 100 men, many of whom were from Farmville and vicinity, and it is on record that they made good bridge builders too.

Since the development of the great coal and iron traffic from Southwest Virginia, the Norfolk & Western Railroad (succeeding A. M. & O. R. R.) has found it necessary to keep up with its competitors by heavily increasing the weight of its rolling stock, and strengthening its structures. Early in 1866, the Edge Moor Iron Company of Delaware and Fred H. Smith, of Baltimore made a contract to remove the Iron Fink truss from the iron towers, and replace it with a steel and iron Pratt truss of best modern design and highest quality of workmanship and materials; the new truss to rest its inclined end posts on bed plates, shoes, etc, on the granite coping stones, thus relieving the towers of nearly all their strain and giving them only the duty of end panel posts. The new bridge is proportioned to carry a coupled-up train of consolidation engines with full tenders, and when thus loaded no member is to be subjected to more than 40 per cent. of the strain that would give it a permanent set or stretch. The main tension members are composed of soft steel eye-bars made in one piece without welds, by the Edge Moor process of gas heating the ends of the bars, then upsetting these ends into paddles, then rolling these paddles until they lose their red heat so as to condense them solidly, these operations being performed by hydraulic machinery working under immense pressures; these bars being also thoroughly annealed, after their formation. The compression members are of iron plates and angles riveted together by hydraulic rivetters which hold their pressure until the rivet loses its red heat, thus insuring perfect grip; and these compression members are so constructed that their interior surfaces are accessible for inspection and repainting when necessary. The prescribed qualities in material and workmanship have been ensured by the very rigid system of shop and mill inspection enforced by inspecting Engineer Thos. H. Cleeman, under orders of Principal Assistant Engineer Wentworth, and Chief Engineer W. W. Coe,

The plan of erection adopted is an engineering novelty, there being no trestle works used to support the bridge and trains while making the changes. There is a traveling span resting on the stone copings of the piers outside of the iron bridge. Its bottom chords and diagonals are of iron eye-bars, and its top chords and posts are of wood. Heavy cross beams rest on these top chords and pass across underneath the top iron chords of the old bridge. The iron chords of the old span are blocked up on these beams, until the lower work can be disconnected and removed and placed on truck car running on the railroad track, traveling derrick frames rigged with four complete sets of wrenches and necessary tackles run on rails resting on the outer edge of the wooden top chords of the traveler, and these tackles are used to lift out the old iron members and put in the new members under the old wooden decking without breaking the continuity of the track. When the new span is in place and is carrying the deck, the cross beams are taken out and placed across seven truck cars running on the track, and the top chords of the traveling span are hooked up to the overhanging ends of these cross beams by adjustable rods. These rods are then screwed up, thus lifting the traveling span off the piers, the truck cars are then rolled along the truck to the next span, and the traveler is lowered into place on the piers by unscrewing the hooking up rods. The cross beams are removed from the trucks and replaced on the chords and the next span is treated in the same way. The wooden deck timbers will not be changed at present, having still some life in them.

This traveling span is proportioned to carry 240 tons total load at a safety factor of five and of this forty-five tons is the weight of the span itself with its derricks and other appurtenances. About fifty-five tons is the weight of the new Pratt truss and the old deck and tracks, and 140 tons is the margin for carrying the train service of a span of 112 feet in length. The transfer of this traveler from one span to another requires the track to be red flagged about two and a half hours, and it has been done in two hours and ten minutes. The broad top chords just below and outside the iron top chords are very convenient platforms for the workmen, and the bottom chords afford equal facilities for placing walk planks unimpeded by trestle posts.

There are about forty men on the work and most of these are what are knowd as tiptop bridge men. The work of erection is under the immediate personal charge of John Kane, well known as an expert in handling such work, and the inspecting engineer for the railroad company is Major John W. Goodwin, whom we all know to be a good one. The general design and direction of the work is in the hands of Fred H. Smith, who with the Edge Moor Iron Company is also finishing up the last of eight double track bridges on the Philadelphia extension of the Baltimore & Ohio Railroad, and putting a metal roof 600 feet long on the side walls of a tunnel under Twenty-fifth street, Philadelphia, for the same company. This roof is composed of heavy iron cross girders or rafters covered by steel buckled plates, galvanized, and upon these plates there is to be a water proofing mastic, then ballast covered by heavy granite paving blocks, similar to the construction suggested for the proposed Arcade Railway under Broadway in New York City.

BRIDGETON, N. J.—Judge Reed having refused the application of Colonel John D. Watson for a certiorari, he has been ousted from the Vineland Gasworks Co. The Sheriff went over from Bridgeton, and proceeded to take possesion in behalf of John R. Farnum, and afterwards applied to the local authorities for officers to guard the building. The works were barricaded and the Colonel resisted the service of the papers, saying that they were procured illegally.

Security of Americans in Mexico.

The following is an extract from a letter written by Hon. A. R. Shepherd, formerly of Washington, D. C., in answer to an article in the New York *World* of June 23d.

OFFICE CONSOLIDATED BATOPILAS SILVER MINING COMPANY, BATOPILAS, STATE OF CHIHUAHUA, June 16, 1886.

To Hon. William R. Morrison, Chairman Committee on Ways and Means, House of Representatives, Congress of the U. S. A., Washington, D. C.

I have resided continuously in Mexico for nearly seven years; represent several millions of American capital invested in mining enterprises, employ a very large number of operatives (American as well as Mexican) have dealings with four of the principal customs houses of Mexico, viz.: El Paso, Nogales, Guaymas and Mazatlan, have imported large quantities of supplies, machinery, etc. etc., and have sent out many millions in bullion, through and over the Sierra Madre, and can say in all truth that so far as my experience goes, the conclusions reached are without foundation and untrue.

Further the general Government of Mexico to-day controls (as far as is consistent with a Republican Government) all State Governments and officials, and any wrong inflicted upon an American citizen meets with prompt and effective reparation.

That the present Mexican tariff is oppressive and burdensome is in many respects true, (as is that of the United States) but efforts are being constantly made by the Mexican Government to adapt it to the necessities of trade and it cannot be doubted that a proper spirit manifested by the United States Government would be met more than half way by the Government of Mexico, and great good result to both countries.

As to the treatment of American citizens by the Government I will give you a case in point.

Some time ago, at a national celebration in this place, I was present with my family; one of the orators (under some malign influence) during his speech made a reference hostile to Americans. I resented this action by leaving the place, and refusing to be present at the dinner and ball given the following day. The committee in charge of said celebration promptly sent a letter of apology, censuring in strongest terms the offender and withdrawing the invitation which had been sent him to the entertainment. The State and Federal authorities on learning of it, instituted criminal proceedings against this person for using incendiary language, and only discontinued them at my request, the offending party having made a public and ample apology.

I cite this as an instance of the spirit animating the great majority of the Mexican people as well as their State and Federal Governments. In my opinion life and property is as secure in Mexico to American citizens as in any part of the United States; and the proportion of violence and crime far less. Probably fewer people have met violent deaths in Mexico since the French intervention than were killed in the horrible riots of Chicago during the past month, or have been murdered yearly by Geronimo and his savage horde in the territories of the United States Government under the Pecksniffian sentimentalism which permits these wild beasts to ravage and murder under the eye of the United States army.

Americans who respect themselves and their nationality (the only American entitled to respect) can pursue their vocations as safely in the cities or Sierras of Mexico as in the heart of the largest cities of our own country, and it is most unjust, unchristian and unAmerican to send forth such unfounded conclusions and misrepresentations from so distinguished a committee as the one over which you preside.

Very Respectfully your Obedient Servant.

ALEX. R. SHEPHERD.

St. Gothard's Help to Trade.

From the Pall Mall Gazette.

Every one by this time has been through St. Gothard Tunnel, and most travelers no doubt imagine that the line was made in order to facilitate their tours to the Italian lakes and Milan. The fact, however, is that the line was made not for the tourists but for he traders. This comes out very clearly in the report just published of a commission appointed by the French Government to inquire into the economic consequences of piercing the St. Gothard mountain. The line was opened for traffic on the 1st of January, 1882. Since then Germany has increased the value of her exports to Italy from 66 000 000f. to 110 000 000f., and to Spain (by Genoa) from 51,344,000f. to 83,679 000f. As for Switzerland, in 1881 her exports to Italy were valued at 37,000,000f.; they have now risen to over 75,000 000f. Italy has benefited even more. Her exports to Switzerland, Germany, and Belgium have risen by leaps and bounds, and the commerce of the port of Genoa in particular has increased since the St. Gothard line was opened by 50 per cent What Italy has gained France has lost. Merchandise from the North wishing to reach the Mediterranean is more and more coming to be sent to Genoa instead of Marseilles. The former port, thanks to the St. Gothard line, has the advantage in distance over Marseilles as follows: From Antwerp, 76 kilometers; Ostend, 34; Charleroi, 68; Brussels, 76; Namur, 127; Amsterdam, 139; Utrecht, 162; Cologne, 220. The report concludes with some suggestions as to how France can best meet the Italo-Swiss-German combination and checkmate the St. Gothard line. Lovers of the picturesque will be glad to hear that the report points to a less desperate remedy than destroying another Alpine pass and making a new tunnel. What has to be done is to lessen the distance between Marseilles and the north. All the French lines were constructed with Paris as their sole objective, and the report makes various practical suggestions for new lines in order to avoid the Parisian detour. I would only need the construction of 50 miles of new lines, it seems, in order to shorten the distance between Antwerp and Marseilles by 70 miles, and thus beat the St. Gothard hollow.

Zalinski's Dynamite Gun.

The following is from a late issue of the New York *Times*:

Lieutenant E. L. Zalinski yesterday fired four blank shells from the pneumatic dynamite gun at Fort Lafayette. The object of the experiments was to ascertain the difference in flight made by various centers of of gravity on the projectile. The first shell weighed 140¾ pounds, and the center of gravity was 20¾ inches from the end of the projectile. The elevation was 14 degrees. The projectile remained in the air 9 6-10 seconds. Forty pounds of air were lost. In the second projectile the center of gravity was 23 3-16 in. from the point of projectile. The shell was 9 8 10 seconds in the air. Forty-eight pounds of air were lost. In the third projectile the center of gravity was 25¼ inches. The shell was 9 6-10 seconds in the air. The loss of air was 40 pounds. The distance made by each of the projectiles was about 2,000 yards. The fourth projectile was one designed by Colonel John Hamilton, with a spiral tail, to induce revolution. The projectile weighed 159 pounds, was 8 feet long and the center of gravity was 16 11 32 inches from the point where the head joined the tube. The shell was fired from an elevation of 34 degrees. It was 19 1-10 seconds in the air. The distance traveled was 2½ miles. Lieutenant Zalinski thought that the effect of the spiral accessory was to steady the projectile in its flight.

Congress has appropriated $350,000 for the construction of a dynamite gun cruiser to accomplish certain defined results. Lieutenant Zalinski is to be congratulated in his successful progress with his gun thus far, and we hope his success may be permanent.

WATER

WABASH, IND., WATER WORKS.—As per advertisement in ENGINEERING NEWS, the city of Wabash, Ind., received and opened the following bids, on the evening of July 26th, for the construction of water-works in accordance with plans and specifications adopted by councils. The party to whom the contract was awarded to be granted a franchise for the term of twenty years. System to consist of stand pipe 100 feet high, 25 feet in diameter, ten miles of mains, 100 hydrants, two 1,500,000 gallon engines together, with boilers of sufficient capacity to operate the aforesaid pumps, engine house, and all the necessary gates, boxes and valves required for the successful operation of the works.

E. D. Martindale, Indianapolis, $50 per hydrant per annum for 100 hydrants, and $40 dollars per hydrant for all additional hydrants.

H. Dukes, Peru, Ind., $48 per hydrant per annum for 100 hydrants each; additional hydrant $30.

Turner, Dellaway & Ranson of Boston, $45 per hydrant for 100 hydrants, and $40 for each additional hydrant.

Samuel R. Bullock & Co., New York, $45 per hydrant for 100 hydrants, and $35 per hydrant for each additional hydrant.

Council met on Tuesday evening, July 27th, and awarded the contract to Samuel R. Bullock & Co., they being the lowest and best bidders.

The Starr contract was $4,000 per annum for 124 hydrants located on 12¼ miles of pipe, and work to be completed in conformity with about same specifications.

DRAINAGE IN ILLINOIS.—The Ornargo, Douglas and Danforth special drainage district in Iroquois county embraces about 16,500 acres of land. The Commissioners were elected about two years ago, and have caused to be laid out a system of drains reaching every forty-acre tract. It comprises twenty-nine miles of open ditches, from 3 to 13 feet cut, averaging about 6½ feet deep, and sixty-one miles of tile trains, varying in size from 6 to 15 inches in diameter, to be laid at an average depth of 4¼ feet. By this system about 6,500 acres of land will be reclaimed, and the remainder largely benefitted. The highest assessment on farm land will be about $7.25 per acre and the lowest about $2.25. The total estimated cost is about $75,000, and the benefits to be derived by the work will be about $160,000. It is expected about fifteen miles of the open ditches will be constructed by dredging machines, and the remainder with plows and scrapers.

PITTSBURG WATER CONSUMPTION.—The people of Pittsburgh Pa., are said to use more water than any other city in the world, except Rome, Italy. Every man, woman and child is at present using 185 gallons a day. That is, there is enough being pumped and sent into the pipes to give every individual in this city this amount for daily consumption. A very small part of it is drank, of course, and much more might be used for bathing than is, so the only explanation left of what is done with the enormous amount pumped is that it is wasted. The city reservoirs supply 26,000,000 gallons daily, and the Monongahela Water-Works, on the South Side, 11,000,000. According to the estimate of the Board of Health there is a population of 202,000 in Pittsburg, 55,000 of whom on the South Side are supplied by the Monongahela Water Company. This would make the consumption for every man, woman and child on the South Side 200 gallons, and in the old city 172 gallons a day, or an average of 185 gallons for every person in the total population.

NEWS OF THE WEEK.

Contracting.

Asphalt Paving.—The contract for asphalt paving on St. James St., Montreal, has been awarded to Messrs Warren & Scharf, of New York City. The contract price was $2.80 per square yard, the old macadam to be utilized.

Iron Paving.—An iron roadway has been laid at Chicago; it consists of narrow rolled iron bars with indentations, to afford a foothold, at intervals of 6 inches. The rails are fastened to 2 inch planking, and are bound together at intervals of 3 inches by wrought-iron staples. The pavement, which is in sections 12 feet in length by 2 feet in width, is laid on a bed of sand, with granite blocks next to the curb and railroad track. The spaces between the rails are filled up to the street level with tar and sand.

Brick Paving.—At Steubenville, O., a brick pavement was laid two years ago, which is said to give entire satisfaction in point of cost, durability and safety. The street was excavated 1 foot below grade, and the space was filled in with 4 inches of sand, 4 inches of gravel and 4-inch firebrick laid on edge; the top being covered with sand to work into the joints. The city pays 83 cents per square yard, this price including materials and laying. The main street is laid with this pavement.

City Work for Contractors.—Engineer A. R. Roberts, of the Department of Highways, Philadelphia, declares that for various reasons, it is almost impossible to induce first-class firms to bid for city work on bridges, on account of the impediments that are thrown in their way and the uncertainty of prompt payment. He cites a recent instance where advertisements were printed for proposals for a new iron bridge over the Norristown Railroad, at Spencer street, in the Twenty-eighth Ward, for which a special appropriation had been made by Councils. Mr. Roberts personally solicited several of the best-known bridge builders in and around the city to bid for the job, but the invariable reply was that they could not afford to do such work for the city except at a very large margin of profit, as the chances of prompt payment were too small, and they preferred to work for railroad and other corporations, with which they have no trouble and which pay promptly for work on completion.

International Competition for Designs and Construction of Two Graving Docks at Genoa.—A competition for the designs and construction of two large graving docks is now opened to engineers and contractors of all nations. The plans and tenders will be received up to the 31st of December next, by the Minister of Public Works, Rome. In the event of the government not accepting any of the tenders, a premium of 15,000 lire (15,000 Italian lire) will be paid for the drawings of each of the two docks, which may be selected as the best and most suitable; such designs, in that event, will become the property of the government, which is not bound to accept the lowest or any tender. The following are the principal dimensions of each dock:

	Dock No. 1. Mets	Ft. Ins	Dock No. 2. Mets	Ft. Ins
Length at bottom	160.00	524, 9	200.00	656, 2½
Width at coping	29.52	96, 9	25.00	82, 0
Width at bottom	24.00	78, 9	18.38	60, 3¾
Height, coping above mean sea level	1.50	4, 11	1.50	4, 11
Depth, bot om below mean sea level	10.00	32, 9½	9.00	29, 6
Height of coping of entrance above M. S. L.	3.00	9, 10	3.00	9, 10
Depth, cill of entrance below M. S. L.	9.00	26, 6	8.00	26, 3

Dock No. 2 is to be built with two grooves situated respectively at 90 metres and 130 metres (295 ft., 4 ins. and 426 ft. 5 ins.), from entrance for the caissons, in order to be able to form two separate basins of 90 and 110 metres (295 ft. 4 inches and 360 ft. 10½ ins.), or of 130 metres and 70 metres (426 ft. 5 ins. and 229 ft. 9¼ ins.) each.

Market Street Bridge.—Mayor Smith, of Philadelphia, has announced his intention to veto the ordinance awarding the contract to R. A. Malone & Son. Three reasons are given by the Mayor for his decision: First, the loose manner in which the ordinance is drawn; second, because he thinks that before the bill is approved the Traction Company should be bound by separate agreement to pay for the slot for their railway across the bridge, instead of having this depend simply upon a proviso containing a guarantee to that effect; and third, because the ordinance gives to the chief engineer and surveyor more discretionary power than is allowed by the general ordinance of 1877 relating to contracts.

Contractors Intelligence,

Reported by T. H. Boorman.

Engineering and Building Materials.

WHOLESALE PRICES.

New York, August 12, 1886.

IRON.

STRUCTURAL IRON.		
Angles	2.00c @	2.10c
" steel	2.35 @	2.45
Tees	2.35 @	2.45
Beams and channels, American	3.0 @	
Tank plates	2.10 @	2.20
Shell plates	2.4 @	2.5
Steel plates, Tank	2.70 @	2.75
WROUGHT-IRON PIPE. PITTSBURG.		
Butt welded, black ..... Discount		45
" galvanized ..... "		35
Lap welded, black ..... "		60
" galvanized ..... "		42½
Boiler tubes ..... "		52½
RAILS.		
Steel (large lots at mill)	$34.00 @	$35.00
Old rails	19.00 @	
Old rails, steel	22.00 @	23.00
R R. spikes		2.40c
R R. splice-plates	1.80 @	2.00
R R. track bolts, square nuts	3.00	
Barb-wire fencing, galvanized	4.38	
" painted		4.00
Corrugated iron		
Nails		
Iron, per keg	2.10	
Steel do.	2.20 @	2.25

METALS.

COPPER.		
Lake Superior	10.10 @	10.30
Other Brands	9.38 @	9.75
LEAD.		
Com. Domestic	4.75 @	4.80
Lead Pipe	.06¾c.	
Tin-Lined Lead Pipe	.15	
Sheet Lead	.07¼	
ZINC.		
Sheet	5.80	

BRICK.

Cargoes (afloat)		
Choice Brands	7.25	
Haverstraw ..... per M.	6.25 @	7.00
Fishkill	5.50 @	6.25
Up-River	6.00 @	6.50
Jerseys	5.50 @	6.00
Long Island		
Pale	4.50 @	4.75
FRONTS.		
Croton, red	11.00 @	15.00
" dark	11.00 @	15.00
" brown	10.00 @	14.00
Philadelphia pressed	27.00 @	28.00
Trenton "	25.00 @	26.00
Baltimore "	37.00 @	41.00
Buff "	33.00 @	35.00
Enameled English	85.00 @	130.00
" American	80.00 @	120.00
Fire brick	25.00 @	55.00
" American, No. 1	30.00 @	35.00
" " No. 2	25.00 @	30.00

ASPHALT.

ROCK.		
French	$20.00 @	25.00
German	15.00 @	30.00
According to quantity or brand, and whether taken from vessel or store.		
PAVEMENT.		
Barber's Asphalt	$2.50 @	$3.00

LIME.

Rocklock Cement Co.'s Ground	.80
Rockland, common per bbl	1.00
" finishing	1.20
State, common	.85
" finishing	1.05
Kingston, ground	.90
Add 25c. to above figures for yard rates.	

STONE.

Cargo rates at New York.

Amherst freestone, No. 1 per cub. ft.	0.95 @	1.00
" " No. 2 "	0.75 @	0.85
" " light drab "	0.80 @	0.95
Berlin " in rough "	0.75 @	1.00
Berea " "		
Brown stone, Portland, Ct. "	1.00 @	1.35
" Belleville, N. J. "	0.75 @	1.35
Granite, rough	0.45 @	1.25
Common building stone per load	2.00 @	3.00
Base stone, from 2½ to 6 ft. lengths, per lin. ft.	0.40 @	3.00
Concrete and macadam stone, Tomkins Cove, per cub. yd		$1.65

SLATE.

Purple roofing per square	6.00 @	7.00
Green "	6.00 @	7.00
Red "	15.00	
Black Penna. (at New York) "	4.50 @	5.00

LUMBER.

Prices for yard delivery in New York.

PINE, Common box per M.	18.00 @	20.00
" Choice "	65.00 @	70.00
Tally plank, 1¼ in. 10 in. dres'd, each.	.44 @	.50
Tally boards, dressed com. "	.28 @	.30
SPRUCE, Boards dressed "	.25 @	.28
Plank, 1¼ in "	.28 @	.30
" 2 in. "	.38 @	.40
" 2 in. dressed "	.43 @	.45
Timber per M.	13.00 @	16.00
HEMLOCK, Boards each.	.18 @	.20
Joist, 2¾ × 4 to 4 × 6 in	.16 @	.44
OAK per M.	55.00 @	65.00
CYPRESS 1, 1¼, 2 and 2¼ in "	35.00 @	40.00
YELLOW PINE, Girders "	25.00 @	30.00
Dressed flooring "	28.00 @	35.00
SHINGLES, Extra shaved pine, 16in. "		
" sawed 18 in. "	5.75 @	6.00
LATH, Cargo rate "	2.00 @	2.10

PAINT.

Lead, white, American dry per lb	.04¾ @	.06¼
" " " in oil pure "	.07 @	.07½
" English, B. B. in oil "	.08¼ @	.08¾
" Red, American "	.06½ @	.07
Litharge "	.05½ @	.06
Venetian red, American "	.01 @	.01¼
Indian red "	.08 @	.10
Vermillion, American lead "	.10½ @	.11½
Paris green "	.15 @	.18
Umber, Amer. raw and powdered per lb.	.01¼ @	.01¾
Drop black, Amer. "	.07 @	.13
" " Eng. "	.11 @	.13
Chrome green "	.10 @	.25
Oxide zinc, American "	.03½ @	.03¾
" French "	.05½ @	.07½

CEMENT.

The following price current is made up entirely from quotations furnished us directly by the firms dealing in each brand; the prices are understood to be wholesale in New York, subject to such special rates as large quantities may warrant:

CALVIN TOMKINS:		
"Old Newark Co's." Cement		$1.10
BAETJER & MEYERSTEIN:		
Hanover Portland	$2.60 @	$2.65
BELLONI & CO.:		
Hemmoor "Crown" brand		2.50
JAMES BRAND:		
Burham	2.25 @	2.50
Fewen	2.25 @	2.50
BROOKS, SHOOBRIDGE & CO.	2.45 @	2.60
HOWARD FLEMING:		
Gibbs' English Portland, 400 lbs.	2.50 @	2.75
" K. B. & S. " "	2.25 @	2.50
Stettiner, German	2.65 @	2.85
Lagerdorfer, "	2.45 @	2.75
Fieve, A 1, Belgian	2.35 @	2.50
Roman	2.75 @	3.00
Keene's Coarse	4.75 @	5.50
" Fine	7.75 @	8.50
" Superfine	8.50 @	10.00
FISHER, ERSKINE W.:		
Stettin (German) Portland Cement	2.40 @	2.75
GABRIEL & SCHALL:		
Vorwohler "Lion"	2.65 @	3.10
HUDSON RIVER CEMENT CO. Rosendale		0
JOHNSON & WILSON:		
Saylor's American Portland	2.15 @	2.45
LESLEY & TRINKLE, Philadelphia, Pa.:		
"Giant" Portland	2.20 @	2.40
Improved "Union"	1.25 @	1.50
Union	1.10 @	1.20
MARCIAL & CO.:		
J. B. White & Bros. Coarse Keene's	4.25 @	4.50
" Superfine	7.25 @	7.50
" Portland	2.65 @	3.00
NEW YORK CEMENT CO.:		
Rosendale		1.10
N. Y. & ROSENDALE CEMENT CO.:		
Rosendale, "Bridge" brand		1.10
SINCLAIR & BAUSON:		
Alsen's Portland Cement Works	2.35 @	2.85
K. B. & S.	2.25 @	2.50
STANDARD CEMENT CO		
E. THIELE:		
Dyckerhoff	2.90 @	3.25
UNITED STATES CEMENT CO.:		
English Portland	2.25 @	2.40
German "	2.00 @	2.15
Standard	1.50 @	1.65
Windsor and Improved Rosendale	1.00 @	1.10
UNION AKRON CEMENT CO.:		
Akron "Star" brand	1.00 @	1.10

MARKET SUMMARY.

The Brick market is not lively, manufacturers are shipping here freely, and although the best qualities are in good demand, cargoes not fully up to the standard, are hard to dispose of. Up Rivers have been sold at $5.50 per M; Fishkill, at $6.25 per M; Philadelphia and Trenton brick are of steady sale; Croton Point are not called for to the same extent as last year; some makes have not proved satisfactory and have been sold for less than our quotations, which are for best quality. The Cement market is about as last week, manufacturers of Rosendale have to shade their figures to make immediate deliveries; Portland continues to be sold in large quantities; among the sales are noted 1000 barrels of "Anchor" Stettin for Western shipment; the Lime market is steady, Rockland manufacturers have stopped shipments until August 23 to prevent any over supply; the sale of 3000 barrels, St. John, is reported at 95c. per barrel. The Lumber market is steady, with an improvement in the price of Spruce timber which is now firmly held at from $13.50 to $16 per M. The serious fires in the western lumber regions, it was anticipated might cause a rise in the price of Pine, but by last advices no change had been made in card rates; Yellow Pine is in good demand; Lath is in fair demand at $2 to 1.10; sales reported at $1.90, are for small lots of inferior quality, for small bills of best quality as high as $2.15 has been obtained. The Hardware market is in about the same condition as last week, with possibly an increased number of out-of-town orders. Dealers keep up their prices and do not appear to press sales by making reductions. The Paint and Oil market shows no fluctuations of any account; Linseed Oil and Turpentine as last quoted; Colors unchanged; Prince's Metallic Paint has been in such demand that orders cannot be filled for immediate delivery, and sales are reported, booked ahead for two months; Lead has been sold a little lower during the beginning of the week, but 4.80c. is now the lowest figure; Tin Plates are unchanged; Pig Tin sympathizing with the London market, has been stronger, and sales in quantities have been made at $21.85 to $21.90 per ton for Straits; Plaster and Hair unchanged.

BUILDING ITEMS.

Messrs. C. Abbott French & Co, 200 West Fifty-seventh Street, report four buildings, for which they have just finished plans, to be built at Long Branch for Mr. Wm. Lumley; they consist of a one and a half st ry, cattle barn, 200 x 175; a stable and carriage house, 75 x 225; a model hennery, 60 x 120, and a dairy and refrigerating house, 25 x 35; cost not yet estimated. For the Cutting estate, a model tenement house, 100.11 front, is to be built on the southwest corner of Avenue C and Fourteenth street, from plans just completed by Mr. C. C. Haight; cost not yet estimated.

Mr. C. H. P. Gilbert has drawn plans for an Episcopal church to be built at Hazelton, Pa., by days work.

Mr. H. Edwards Ficken has designed a four-story brick extension to Nos. 70 and 72 Forty-sixth street for Mr. Amos Woodruff, to cost $25,000. Mr. George Edward Harding is the architect for improvements to be made in the residence of Mr. Frank Work, No 13 East Twenty-sixth street. Mr. Bradford L. Gilbert is drawing plans for the new building for the Harlem branch of the Y. M. C. A.; he is also the architect for alterations to be made to their building, No. 57 East Twenty-third street, which are to cost about $15,000; The Harlem branch, new building is to be built on One Hundred and Twenty-fifth street, near Fifth avenue, and is to be 50 x 144 feet, containing a swimming bath and gymnasium. Bids for the construction are now being received.

Messrs. McKim, Mead & White have completed plans for ten three-story and basement residences, 20 x 42 each, to be built at a cost of $70,000 on St. Ann's avenue from One Hundred and Thirty-fourth to One Hundred and Thirty-fifth streets for Mr. Theodore G. Thomas.

Mr. Jas. E. Ware is the architect for a five-story brick warehouse, to be built on the north east corner of Thomas and Hudson streets for Mr. Joshua Jones at a cost of $95,000. L. N. Crow contractor.

The Commissioners of Charities and Corrections on Tuesday awarded the contract for building the Bellevue Hospital Morgue to Messrs. V. J. Hedden & Sons.

Messrs. D. and J. Jardine have prepared desins for Mr. Wm. Meles for a three-story and basement, brick and stone residence, 25 x 55, to be erected on the south side of Seventy-first street; cost of the Boulevard.

The Secretary of War has accepted the bids of Moran & Armstrong for the mason work, and of James L. Lowery for the carpenter work on the building to be erected for the Department on Whitehall street. Mr. Stephen D. Hatch is the architect.

Messrs. Van Dolsen & Arnott have been awarded the contract for the erection of the factory for the Morrison Building Co. on Ryerson street, near DeKalb avenue, Brooklyn, which is to cost $60,000. Messrs. Lamb & Rich are the architects.

Mr. Henry T. Warren will erect five five-story flats to cost $75,000 on the northwest corner of Eleventh avenue and Sixty-seventh street.

The contract for the foundations of the extensions of the Suburban Rapid Transit Co. has been awarded to Smith & Ripley, of this city; Mr. J. J. R. Croes, Engineer. Calvin Tompkins will furnish the contractors with the materials for the concrete, which will require 7,000 barrels old Newark Co.'s Rosendale cement; 6,000 cubic yards Tompkins Cove broken stone, and about 5,000 yards of sand.

The high road from City Island to Pelham is to be macadamized with Tompkins Cove, 1½ inch crushed stone; about 4,000 cubic yards will be required. Sheehan & Molloy are the contractors; Mr. Wm. Haskins, Engineer.

Isaac A. Hopper has been awarded the contract for building the Washington Monument at Newburg, N. Y. John H. Duncan, of this city, is the architect.

T. H. Poole, 36 East Twenty-third street, reports on the boards plans for a four-story marble rectory, 22 x 58, to be built on Ninetieth street, between Second and Third avenues for the church of Our Lady of Good Counsel; cost about $20,000.

Messrs. D. & J. Jardine have drawn plans for an extension about 40 x 64, three-story and basement, to be added to the residence of Mr. J. A. Bostwick, northeast corner, Fifth avenue and Sixty-first street.

Wilbur S. Knowles reports designs being prepared for five three-story and basement brick residences, to be built at a cost of $25,000 to $30,000 at Omaha, Nebraska, for Mr. Wm. Koenig, of this city.

Detroit Brickyards Idle.

DETROIT, Mich., August. 10—The builders' lock-out continues, and nearly everything in that line is at a standstill. The large brickyards just outside the city, as a consequence of this state of things, have shut down, and, they say, will not open again this season. This affects 400 families and 2 500 persons. The men were getting $1.60 per day and house rent, and are anxious to continue work, but, with large stocks of brick on hand and no demand in consequence of the lock-out, the boss brickmakers dare not keep on accumulating stock. There is no prospect of any present termination of the lock-out, and the prospects are gloomy enough. Other branches of the building business will soon be affected in a similar way. It has leaked out that the Builders' Union have sought to freeze out all small builders and contractors by agreeing to refuse to bid on contracts that were submitted to men outside their number, or to give figures to architects who did not steer all jobs exclusively into their circle, and have, as far as possible, brought their power and influence to bear on the stonecutters' and bricklayers' unions to prevent them from engaging to work for contractors other than themselves They have by this method of proceedure succeeded in securing the lion's share of the building contracts, and otherwise exercised a very tyrannous control over the building business.

Big Storms and Things Predicted.

The meteorologist, Professor Foster, of Burlington, Iowa, says in "The Burlington Hawkeye" of the 11th, that one of the greatest storm periods of 1886 will begin on August 16th, and continue till August 27th, during which the greatest drought will be completely broken by heavy rains, hail and tornadoes and heavy gales. A tropical hurricane will take place on the southeast Atlantic coast between August 16th and 20th. These storms will be general, and Iowa, Illinois, New England States, eastern Canada and Labrador will be in the danger path. Vivid sun spots from August 18th to 24th, and brilliant auroras on August 20th and 23rd.